Electrical World and Engineer

THE CONSOLIDATION OF "THE ELECTRICAL WORLD" AND "ELECTRICAL ENGINEER."

VOL. XXXVI. NEW YORK, SATURDAY, SEPTEMBER 1, 1900. No. 9.

PUBLISHED EVERY SATURDAY BY

ELECTRICAL WORLD AND ENGINEER

(INCORPORATED.)

120 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 4044 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

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EUROPEAN OFFICE, - - - - - - - - - - - A. C. Shaw, Manager.
Hastings House, Norfolk St., Strand, London, England.
PARIS, - - - - - - - - - - Electricity Building, Paris Exposition.

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ELECTRICAL WORLD AND ENGINEER.

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Change in advertisements intended for a particular issue should reach the office of the ELECTRICAL WORLD AND ENGINEER on or before MONDAY morning of the week of issue. New advertisements can be received up to 10 A. M. of Tuesday of the week of issue.

The first issue of each month is an export issue, having an extraordinarily large foreign circulation in addition to the regular domestic and foreign circulation of this paper.

TERMS OF SUBSCRIPTION.

United States, Canada or Mexico, - - - - - - - - - - - per year, $3.00
Foreign Countries, within the Postal Union, - - - - - - - - - - - 6.00
Single Copies, - .10

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Entered as second-class mail matter at the New York Post Office.

NEW YORK, SATURDAY, SEPTEMBER 1, 1900.

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EXPORT MANUFACTURES.

Some data is given in our Commercial Intelligence Department as to the generally encouraging conditions of electrical and other manufactured exports. But those figures do not tell the whole story, for the favorable conditions improve. It now appears that for July, which is one of the dullest trade months of the year, the exports of manufactures were $34,545,000, or over 35 per cent of the total exports of that month.

There is, indeed, no good reason to doubt the continuance of such a trade and its rapid development if persistently pushed. The approaching pacification of South Africa has already renewed the demand from that quarter, while prosperity in South America and Australia is also stimulating inquiry in both of those sections of the globe. As for China, we publish this week a most interesting article by Dr. Jaisohn, who indicates very clearly what may be expected there. Fancy the lighting, traction and telephonic possibilities of fifty cities, each of 100,000 people! And that they should have these facilities within a few years may be as much a possibility as was the social revolution that has made Japan one of the most progressive countries on the face of the earth. Some one is going to bring China up to date.

SPECTACULAR ILLUMINATION.

This week in our series of articles on the Paris Exposition an account is given of the manner in which the front of Electricity Building is lighted for decorative purposes of illumination. The method is very ingenious. As will be noted, the upper front of the building is nothing but a semi-transparent screen in glass and zinc; it is not even a wall. It is lit by several thousand incandescents of different colors and groupings, yet the system is so arranged that these can be entirely cut out and other effects obtained by projector arcs. Such a happy and curious combination of arc and incandescent methods has never been resorted to before. A façade has been decoratively lit by either one illuminant or the other; never by both at will. It is also noteworthy that this lighting breaks away from the hard arbitrary lines copied from gas jet lighting. The front of Electricity Building at night is a pattern of lace, a beautiful open fan, a fantastic design in tapestry—anything and everything but a conventional piece of structural lighting.

A JOINT MEETING.

The joint meeting of the British and American Institutes is reported by our correspondents as having been very successful as a function, although there was not sufficient time to obtain a full and general discussion of the topic set for the occasion. The benefits of a reunion of electrical engineers are not alone social. Although the facts and principles of electrical engineering are the common property of engineers on both sides of the Atlantic, yet the social, political and commercial conditions are so markedly different in the two countries that it is difficult for the members on one side to fully appreciate the difficulties and conditions of those on the other, without actually coming into personal contact to exchange ideas and opinions. England is not a country of large water-powers and enjoys a humid atmosphere and climate in combination with a conservative but paternal government. The United States, which has many water-powers, is a large country with a dry air, and with a republican form of government not marked for paternal tendencies. The contrast

between the two sets of conditions is at once interesting and surprising. The scarcity of coal and the plentitude of falling water in certain regions of the West lend themselves to the development of electric power transmission; whereas the British electrical transmission engineer has to compete with the steam engine at every point, and is often hampered by statutory limitations.

The drawing together in social reunion of electrical engineers from both sides of the Atlantic cannot fail to establish pleasant and useful mutual relations in the future. The presence of a number of French engineers at the symposium also contributed to the interchange of thought and languages. In fact, the president read announcements in three languages, in a manner which suggested an international assemblage.

The nature of the topic discussed was essentially the question of eliminating electrolytic and inductive disturbances from electric traction systems. There is now no longer any difference of opinion as to the relative advantages of alternating currents for high-pressure transmission, and the only remaining question is whether such a system should be transformed through converters to a direct-current system for operating the motors; or whether the converters should be eliminated and alternating-current motors substituted. The question is one which admits of much discussion, and offers arguments on both sides.

TELEPHONIC COURTSHIP.

A rather extraordinary situation developed in Cleveland recently with regard to the use of the telephone. Miss Agnes C. Smith, a pretty dressmaker, has secured an injunction against J. W. Cobb restraining him from making love to her in any way, even by telephone. Cobb is an ardent admirer of the young lady, but she does not reciprocate his sentiments. He would call at her home, and, upon learning that she was not in, would remain outside the house as late, or early, as 2 o'clock in the morning, hoping to see her, although it does not appear why he expected to see her at 2 a. m. Failing to communicate with her in any other way, he began to use the telephone, sometimes calling her up ten or twelve times a day. The annoyance grew so great that she was obliged to find another boarding house, but even this move failed. After consulting a lawyer she appealed to the courts. Judge Dissette granted the young lady's prayer and issued a restraining order, enjoining Cobb from making love to her in any way, from loitering near her house, from speaking to her on the street, or from calling her over the telephone.

So far as we are aware this is the first order of a court restraining any one from the use of the telephone, but it leaves matters rather mysterious, although conveying a salutary lesson to those who make a nuisance of this great modern boon. We are glad to note that the New York *Herald*, in a recent crusade against telephone nuisances, has sought to discriminate between central and the subscriber in allotting blame. Usually in such diatribes it is all central, and the subscriber is as innocent as an angel. The fact is gradually becoming recognized that one of the largest elements in telephone exchange efficiency is the efficient subscriber who does not "hold his wire," who hangs up his receiver, who knows the correct number he wants, and who does not prolong his conversation one second beyond the period absolutely necessary.

But returning to the pretty Cleveland dressmaker and the enamored Cobb, it would seem that part of the remedy against telephonic persecution lay in her own hands by not paying any attention to the calls. There are still many people who think that if they are called up on the telephone they are morally bound to answer. This is a superstition that is speedily dying out, thanks to the efforts of the man who, coming to your office and being told you are out, goes around the corner and immediately gets you by telephone. In a great deal of the telephonic work to-day it is necessary to tell who you are and what you want before reaching goal, and that is quite proper as a defence of one's time, etc. It would perhaps have been difficult for Miss Smith to interpose an automatic circuit breaker of that nature, but it certainly was quite unnecessary for her to answer the call each time; and, not getting into communication, Cobb would probably soon have tired out. It will be noted that no injunction lay against the telephone company, and it is very likely that if Miss Smith had gone to the manager he would have interposed a benevolent interdict on Mr. Cobb. There are more cases than get into print where attempts to use the telephone as a means of annoyance are very promptly nipped in the bud by exchange managers.

THE CENTRAL STATION OUTLOOK.

This being the usual season of the year for the central station manager to pull himself together and size up the prospects of the winter, we have in a measure followed his example by extending the range of vision and ascertaining the general outlook. In the body of this issue of the ELECTRICAL WORLD AND ENGINEER will be found several important articles dealing with the financial, industrial and technical outlook of the art. While we are confident that such articles as those of Professors Shepardson and W. D. Marks will be read with interest, we are sure that others, such as that on the Nernst lamp and on less prominent developments, will be received with equal attention. It is a matter of common importance to us all to see the efficiency and economy of central stations increased. It is a matter of common duty for all of us to encourage the creation of new channels for current consumption. Each new utility thus developed and perfected, means the addition of a considerable per cent to the value of the stock of every central station company in the country.

As to the reports from the companies themselves, and those of new plants springing into existence, as given in our Supplement, it will be seen that they betoken a very active fall and winter. In almost every instance the outlook is reported as excellent, in some as brilliant, while a general readiness is shown to put in new apparatus and purchase supplies. In fact, from the indications given by our special canvass, it may be fairly inferred that the physical condition of electric lighting properties was never better than to-day, nor was there ever a period when an enterprising manager could count on a better return. He may have made larger profits, but with a broader basis the modest margin of to-day is more sure and stable.

The central station manager is primarily in business to make money, but it is impossible for him not to look around and see how his work is making existence more endurable, comfortable and healthful for every member of the community. He safeguards the streets by lighting them, and within doors his whole work adds to that "agreeableness of life" which is instinctively desired by all. No one can want a better occupation.

AUTOMOBILE EXHIBITIONS.

It does seem as though a word of caution is due in regard to the automobile exhibitions planned in this country. They are so numerous, even a "mug hunter" can hardly keep track of them. New York alone has two in sight, Chicago has another, New Jersey has one, New England at least a couple, and so it goes. In some cases it is a full-fledged show, in other instances it is an annex to a state or county fair, or it is the enterprise of a pushing newspaper or of a man with a hall on his hands. The manufacturer who patronized all of them would find his "circus" department one of his largest sources of expense, just as did the old bicycle manufacturers, until at last in sheer exhaustion they dropped for good and all their costly retinue of racers and performers.

Now there can be no question as to the benefit of a good exhibition, but the thing is being overdone, and it would seem worth while for the manufacturers and others interested to get together and agree as to which of the events they ought to patronize and which they ought to let severely alone. This again was done with considerable success in the days of bicycle expansion, and it might not be a bad policy to revive, for it is undeniable that the automobile exhibition even in these early days is being abused as a means of advertising the art and attracting the attention of the public.

ENGLISH TROLLEY DEVELOPMENT.

United States Consul Murat Halstead at Birmingham favors the State Department with an interesting and suggestive report on the prospective trolley development in that city, where, it will be remembered, some Toronto street railway men invested a year or two ago in the purchase of tram lines, hoping to consolidate and extend the system. He notes the amusing fact that "the city council has recently granted the tram company the privilege of using experimentally on one line the overhead trolley." That at this late day, when in America alone not less than £250,000,000 is invested in the successful operation of trolley lines, the purblind Birmingham city council should have the audacity or the idiocy to require one year of experimenting with the system, gives a vivid idea of the difficulties encountered in introducing electric traction in some benighted parts of the world.

Mr. Halstead notes the tendency of English municipal corporations to go in themselves for trolley traction, if anything is done, and regards this as somewhat obstructive. Still, it is better that England should have municipal trolleys than none at all. Moreover, as Mr. Halstead's report itself shows, municipalities in England have gone in so heavily now for these enterprises, they have overloaded the money market and aroused its doubts, so that the price at which loans for such work are issued is steadily falling. One of the great arguments has been that municipalities could operate more cheaply because they could borrow more cheaply, but it is clear that in England, at least, where the rage has been to municipalize everything, this advantage is a vanishing one.

GROUNDING LOW POTENTIAL CIRCUITS.

The agitation of the past year in favor of grounding secondary or other low potential circuits as a defense against accidents has borne belated fruit in the form of a report from a special committee of the Underwriters' National Electric Association, a copy of which lies before us. As is well known to most of our readers, the step was urged by the American Institute of Electrical Engineers in pursuance of resolutions unanimously passed at the last annual meeting of that body. The present report is the largest step in advance which our friends, the underwriters, have taken for some time, and shows plainly that the old days of mutual distrust and suspicion between underwriter and engineer are slowly but surely passing away. Ten or even five years ago a general demand on the part of those skilled in the art for the grounding of secondaries as a protection against crosses with the primary would have been greeted with anything but civility and would probably have served as the text for a Jeremiad against the deadly high-pressure circuit. But "the world do move," and to say we find the institute and the underwriters' committees settling down to business and uniting upon a programme, certainly means a very material advance in electrical practice. In fact, most of the protest in the present instance has come from the electrical manufacturer with some inward doubts about the results of a conflict between his goods and his old enemy—lightning.

The facts in the case seems to be about as follows: So long as low potential and high potential wires run on the same side of the earth there is a possibility, more or less remote, that the two systems will accidentally get crossed. In such case there is a chance for very serious results, if the cross occurs at a point where it is not at once put out of harm's way by the action of safety devices. No low tension system is or practically can be insulated in such wise as to stand up under the invasion of foreign currents of high potential, and granting the possibility of such an occurrence, there confronts one the choice of taking the chances of the results likely to follow, or of grounding the low tension wires at the risk of causing short circuits in case of a single ground. Obviously if there is a ground anywhere on the low tension system and the neutral is permanently grounded, there is a good chance for fireworks, while it is equally certain that current at several thousand volts pressure, strolling about on a circuit insulated for only a few hundred volts, is likely to be a disorderly and obnoxious visitor. In the former case there is some danger to property, while in the latter both property and life are imperilled. Hence, although at the present time property seems to be regarded as rather more sacred than life, of the two dangers the latter is somewhat the more serious. By encouraging the use of grounded secondaries responsibility will be placed where it belongs. If an avaricious contractor employs incompetent wiremen, or worthless material, on his work will be the danger spot when a permanent ground is put upon the system, while if a high tension current gets upon an ungrounded circuit, the innocent and the guilty suffer together. The underwriters have done most excellent work in discouraging bad construction, and while their judgment as between bad and good has not always been unerring, according to their light they have stood for the use of honest material and careful methods. Their last step is directly in line with this honorable record, and could have been made more effective only by demanding, rather than permitting, the grounding of low pressure circuits. We have seen numerous systems on which an order to ground the neutral point would produce a sudden scurrying about to overhaul the insulation of the circuits. In our opinion it would be wise in taking final action to make grounding permissive at once but obligatory at the expiration of two or three years. Such a mandate would do more toward improving interior construction than pages of specifications. And to tell the truth, no better move could be made toward securing general safety in installation. The objections raised on the ground of the possibilities of accidents under certain and curious circumstances may have been made in good faith, but certainly not in good judgment.

Another step taken by the same progressive committee is the raising the limit of so-called low potential systems from 300 to 550 volts. This is in line with recent progress both here and abroad, and it is certain that the assent of the underwriters will be welcomed by many who have until now been deterred from raising their working voltage to the higher figure. But it must be confessed that a 550-volt system is not devoid of danger, and to call it low potential is straining the ordinary meaning of the term. It seems to us that the continuous use of such pressure inside buildings should be hedged about with such restrictions as shall keep the outside wires so effectively separated that they are not likely to be simultaneously handled. On any system employing a neutral wire the practical danger can be limited to that due to the pressure between this neutral and the other wires, and the interior wiring should be so arranged that this shall be the maximum pressure between wires that are in any way exposed. Higher working voltages have got to come and may be safely employed, but considerable precautions are in order until they become familiar and proper appliances for their use are more generally available than at present.

The Visit of the American Institute of Electrical Engineers to Europe.

The visit of the members of the American Institute to their confréres of the British Institution of Electrical Engineers will long be remembered by all who participated. The meetings, which were entirely social events, took place on the 12th, 13th and 14th insts., in advance of the more formal gathering in Paris. The weather, which had been wet and cold up to the 10th, changed for the better, and on Sunday, the 12th, the American visitors were taken on a steam launch trip on the Thames from Shiplake to Maidenhead. The day was ideal and the beautiful woodland scenery adjoining the river was at its best.

JOHN PERRY.

On the 13th the American visitors were shown the Electrical Laboratories of the Board of Trade at Whitehall, where electrical measuring instruments are standardized and tested. Visits were also made to the General Post Office Telegraph Department, the new Central London (underground) Electric Railway, and the Westminster Electric Supply Corporation. In the evening a dinner was given to the visitors by the president and members of the British Institution. An interesting feature of the programme was a dual proposal of, and dual responses to, the toasts of the occasion, one of each pair being by an Englishman and the other by an American.

CARL HERING.

Professor Perry presided, supported by Mr. Carl Hering, Mr. Alexander Siemens, Prof. A. E. Kennelly, Prof. Silvanus Thompson, Professor Crocker, Mr. E. K. Grey (Silvertown), Mr. R. W. Pope, Mr. W. M. Mordey, Mr. W. Henry, Mr. Mark Robinson, of Willans; Mr. E. J. Benardy, Mr. J. S. Raworth, etc. After the toasts of the Queen and the President of the United States, proposed by Professor Perry, the two-phase system came into action.

Mr. H. H. Cunynghame, C.B., began to propose "Our Guests," and his work was completed by Mr. Raworth. Mr. Carl Hering replied.

Professor Crocker pleaded guilty to having, once upon a time, been a victim to anglophobia. His excuse was that he was born on the 4th of July. He, like many others, had long been cured, and there was no fear of a relapse.

Mr. Mailloux responded in the third place, and explained that he was showing the flexibility of the President's invention in that it admitted of change from two-phase to three-phase. He only regretted that Mr. C. F. Scott was not there to show them how to work it; but he was afraid that if the response was to balance the hospitality they had received, even with three secondaries against two primaries, the secondaries would be grossly overloaded.

Mr. R. W. Pope proposed "Electrical Engineering." Mr. W. M. Mordey pointed out the fact that a large proportion of eminent electrical engineers had been born in Great Britain; while Mr. Steinmetz had been imported from Germany, and once in America turned his attention from the revolution of States to the revolution of armatures, showed his true genius which was for agricultural pursuits, and so cultivated the magnetic field that he made two watts grow where but one grew before.

Prof. Silvanus Thompson said that the English Institution had set the example in taking to travel. Last year they went to Switzerland, this year to Paris, next year it would be Berlin. He hoped that the time would be when they would meet their friends at the other side of the Atlantic.

Mr. A. E. Kennelly said that the longitude of Great Britain was all o. Now that we had extended to the Philippines the mean value of the United States was somewhere about 90. It could not be denied, therefore, that they had got the right angle for their phase relation. It was true this was a far-fetched analogy, as he had to go half round the world to bring it in.

On the 14th the visitors were escorted to the Chatham Dockyard, where they were most hospitably received. Altogether, the reception was a very delightful one.

After the festivities in England, the members of the two societies proceeded to Paris for a joint meeting at the Exposition, as already arranged, and to participate afterwards in the proceedings of the Electrical Congress. Several members of both organizations, attending the Exposition as exhibitors, jurors, etc., were found there awaiting the exercises, of which a report will be found in a later article in this issue.

We present herewith the portraits of Presidents Perry and Hering, and Secretaries McMillan and Pope. We are indebted to Elliott & Fry for the Perry photograph.

The selection of Paris as the place for a joint meeting this year of American and British electrical engineers has proved most judicious, as the large and representative gathering on Aug. 16 in the American Pavilion has testified. The large hall in the fine national building was handsomely decorated with flags and flowers, and Mr. Gilbert, the custodian of the building, provided every convenience for the occasion.

The attendance, which numbered about 150, included the following members of the American Institute of Electrical Engineers: Messrs. C. S. Bradley, F. B. Crocker, W. H. Donner, W. J. Hammer, H. Ward Leonard, R. McA. Lloyd, C. O. Mailloux, E. H. Mullen, R. W. Pope, Oberlin Smith, Jesse M. Smith, W. D. Weaver and J. G. White, of New York; Carl Hering, A. E. Kennelly and Edward Lloyd, of Philadelphia; B. J. Arnold, W. D. Ball and V. R. Lansingh, of Chicago; Alexander Macfarlane, Bethlehem, Pa.; I. R. Edwards, Niagara Falls; R. H. Lohmann, Oakland, Cal.; A. F. Gantz, Hoboken, N. J.; A. S. Garfield and E. W. Mix, of Paris.

Among members of the British Institution of Electrical Engineers present were: Sir William Henry Preece, Gen. C. E. Webber, Profs. John Perry, S. P. Thompson, Walmsley, and W. E. Ayrton, and Messrs. Ferranti, Gavey, W. M. Mordey, Alexander Siemens, and many others whose names are known in electrical engineering literature. Among invited guests were Profs. Mascart, Hospitalier and Janet, and MM. Monpellier, Renaud, Alimet, Korda and Blondin, of Paris; Julius West, of Berlin; Camillo Olivetti, of Italy, and others.

RALPH W. POPE.

At the conclusion of the joint meeting, reported elsewhere, President Perry announced that the time set for the discussion had expired—it then being noon. Prof. Mascart asked the floor to invite the members to visit the French centennial electrical exhibits, stating that all who asked would be supplied with a descriptive pamphlet free of charge. He also offered the use of the jury room of the electrical group to those desiring to rest or write letters while in the electricity building.

W. G. MC MILLAN.

President Perry then announced that arrangements had been made to visit the electrical exposition in four groups, which would be conducted by Prof. Hospitalier, Gen. C. E. Webber, Mr. Carl Hering and Mr. Gavey, technical head of the British telegraph service, with Mr. W. D. Ball and several jury members as assistants. In addition, arrangements had been made to visit on Friday and Saturday the Westinghouse substation, the moving platform (at starting), the electrical department of the Western Railway Company, the Moulineux power station and several other installations of interest.

How Can Central Stations Earn Larger Revenues?—I.

BY ALBERT B. HERRICK.

EVERY lighting station manager in the country has the thought continuously in his mind, "How can the revenue from this property be increased?" The competitive gas industry has, through the application of industrial chemistry to its waste products, reduced the cost of production and earned a revenue which has materially reduced the cost of gas to the consumer; and the possible resources apparent to the lighting station manager along kindred lines are: exhaust steam, condensed water, additional power supplied during the low load periods of the load curve, cinders and ashes. The natural growth in the business of lighting and power superimposes on the peak of the load curve, when the station is loaded at the peak, and does not change the load curve characteristics of this additional station output. This means that, if the station has to be increased in capacity for this business, an additional investment will have to be made bringing up fixed charges against the plant's aggregate output.

The difficulty that the stations have to contend with is an investment to do a large business for only a short period of the 24 hours, and by this business gain a revenue which will make the plant operation profitable. The kind of business that the station manager particularly wants is that business which can be controlled regarding the time of delivery, and which will not interfere with the maximum output of the station. This character of load will not have to bear the fixed charges in such a large ratio as those loads that vary with the daily load, for the reason that they use the station output or the station's "standby" ability to deliver during the period when the machinery is operating under uneconomical conditions, and when the revenue from this operation is often below the cost of its production.

There are several classes of business which present to the electric light industry a possible source of revenue, which could be gained during the periods when the station has only a nominal load to carry. Taking up serially the consideration of these possible subsidiary resources presented to a station, they are included chiefly in steam heating from exhaust steam, in condensed water for ice-making, in steam or hot-water heating systems; in ashes for filling and ballasting, and in cinders for concreting. The other opportunity is to encourage the consumption of the current which is more or less under the control of the management, and is not superimposed on the peak of the station load.

The question then arises, "How can this character of load be obtained; at what prices can it be encouraged; and to what extent can a given plant supply demands of this nature?" It is interesting to estimate the costs, in any particular instance, of what a delivery could be made of steam or power under the conditions of controllable delivery; and with this in mind figures are arrived at which would be sufficiently attractive to demand the utilization of these station products, making them earn enough to bring additional profit to the station.

Taking up first the question of heating by exhaust steam with reference to a station plant, the physical conditions of this business are as follows: It is one which only lasts during the cold months of the year, and the maximum demand on the station is not made when the engines are at their maximum working condition; but the most economical all-day operation of the engines is sacrificed for the purpose of gaining this business. The maximum business that can be taken for this class of auxiliary enterprise is where the temperature can be maintained in the buildings contracted for when the engines are operating under the conditions of low loads. This service is against the maximum station efficiency. All these elements should be estimated on in order to determine the real profit of the operation for the station, and to determine on what prices they should be based.

The topographical conditions surrounding a station to make this auxiliary enterprise possible are that the station should be located within a reasonable distance of the buildings to be heated; that the elevations are such that the steam mains can be drained properly; and that the street admits the employment of such a conduit structure as is required to support the steam main with its insulation and necessary drips.

In order to bring the consideration of this class of business to a commercial basis, it is most practical to assume a given station load curve and operating conditions in order to see the general application to any station, and to indicate methods by which the station manager can make determinations for his plant on its present economy at different periods, and see how auxiliary loads would affect the total economy and costs.

Fig. 1 gives a load curve of the station selected, with a load factor of 25.2 per cent. The plant consists of four 300-hp engines, compound, non-condensing, direct-connected; generator operating on a lighting and motor load; steam at 120 lbs. from three 350-hp boilers; feed water heaters and pumps. The first point is to determine what is the efficiency of the plant at the different periods of the daily loads. In order to do this it is best to weigh out the total coal for one day's run into 20 equal parts, which in this particular case would be 45,950 lbs., or each weighed charge is 2297 lbs. The wattmeter readings are taken at the beginning of the test; the water level is marked in the gauge glasses and the watermeter read. If this is not in place, the pump, if there is no leak, can have attached to it a stroke counter, and the pump can be calibrated by cylinder measurement. Checking this by the number of strokes necessary to fill a tank of known capacity, this will make a fairly reliable tally of the water supplied to the boilers. When the last of each weighed quantity of coal is fired, and if it is necessary to fire the next lot, the wattmeter and the watermeter should be read; and keeping

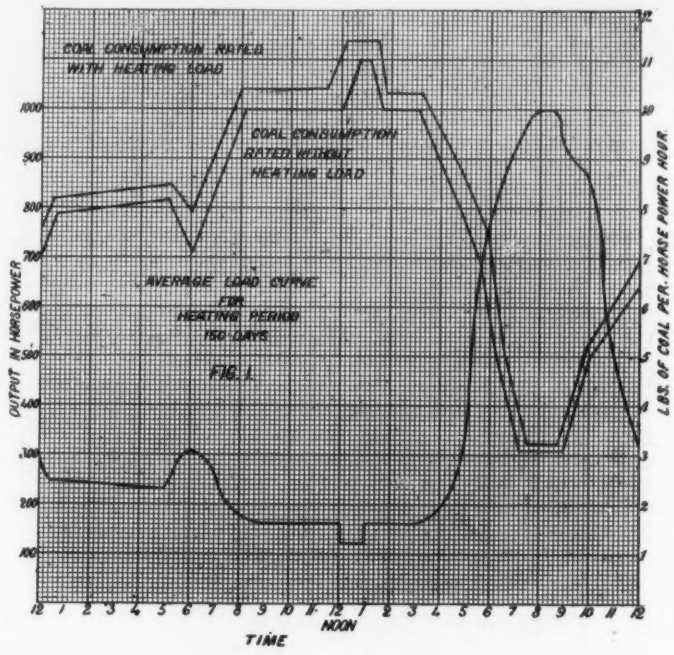

COAL CONSUMPTION RATED WITH HEATING LOAD
COAL CONSUMPTION RATED WITHOUT HEATING LOAD
AVERAGE LOAD CURVE FOR HEATING PERIOD 150 DAYS
FIG. 1.
OUTPUT IN HORSEPOWER
LBS. OF COAL PER HORSE POWER HOUR
TIME
NOON

FIG. I.—LOAD CURVE.

the water level and steam pressure and fires about the same, these values plotted out will give the variable efficiency curve for the different parts of the load. Fig. 1 has the curve plotted out in horsepower hours for convenience in determining what could be done with exhaust steam for heating purposes.

For each period, the watt output divided into the coal burned will give the economy for that period, and the coal divided into the water evaporated will give the evaporation efficiency for that period. If there are any loads on which the data is specifically required, a water rheostat can be connected across the generator to take up the difference between any lower load and the required load. In this way, by taking up the surplus load, a constant load can be maintained in the station for a sufficient period to determine the efficiencies at different loads on the station. A four-hour period will be sufficiently long to get approximate values. These results can be plotted out in a curve which will take the form for the selected station of that shown in Fig. 2.

There are several methods by which the heat units in this steam can be used for heating purposes—in an open heater, for example, the heated circulated water being pumped through the street piping system and then through radiators on the premises of the customer. In connection with this system, there has been proposed a live steam heater to maintain the circulating water temperature. This system has a limited territory below Mason and Dixon's line, as hot water

heating requires a large radiating surface to maintain internal temperature 80 deg. above the external; and circulating this volume of water by steam pumps does not make a very economical showing.

The exhaust steam delivered directly into the steam mains leads to trouble in taking care of the condensed water, and the closings of the radiators throttle the exhaust which has to be relieved through a pressure valve to atmospheric exhaust, which gives the maximum back pressure when the demands on the steam heating system are the lightest. It is also hardly probable that the condensed water, which has value for boiler use, can be drained back to the station.

One method to produce the proper steam distribution is maintaining a vacuum on the return system to bring the condensed water back to the station, and reduce the back pressure necessary on the engines to distribute this steam.

Fig. 1 gives the mean load curve for the heating period, and the upper line gives the pounds of coal consumption per horse-power hour without heating load. The heavy line above gives the added coal necessary to maintain the heating system making up for extra of steam per cubic foot of heating space for the 24 hours. The mean weight of exhaust steam delivered will average over the low load period 4,160,000 cubic feet of steam per day. Prices for heating range from $3 to $5 per 1000 cubic feet of heating space, which will give a revenue of $12,480 for the heating season at the low rate and $20,800 at the high rate.

The business is generally secured by taking it for two-thirds of the present cost of coal maintenance and attendance of the heating systems that it supplants. The return system of drips depreciates more rapidly, due to the distilled water being in contact with it. Credit should, however, be given this system for the value of the hot condensed water returned to the boilers, if water is bought. The oil separator on the engine exhaust steam separates all oil which does not volatilize at the temperature of the exhaust steam, and this water can be pumped back again into the boilers, the water shortage being supplied through a reheater. The arrangement usually effected with stations having a low load factor is to have the piping so arranged as to use only the engines necessary for steam heating

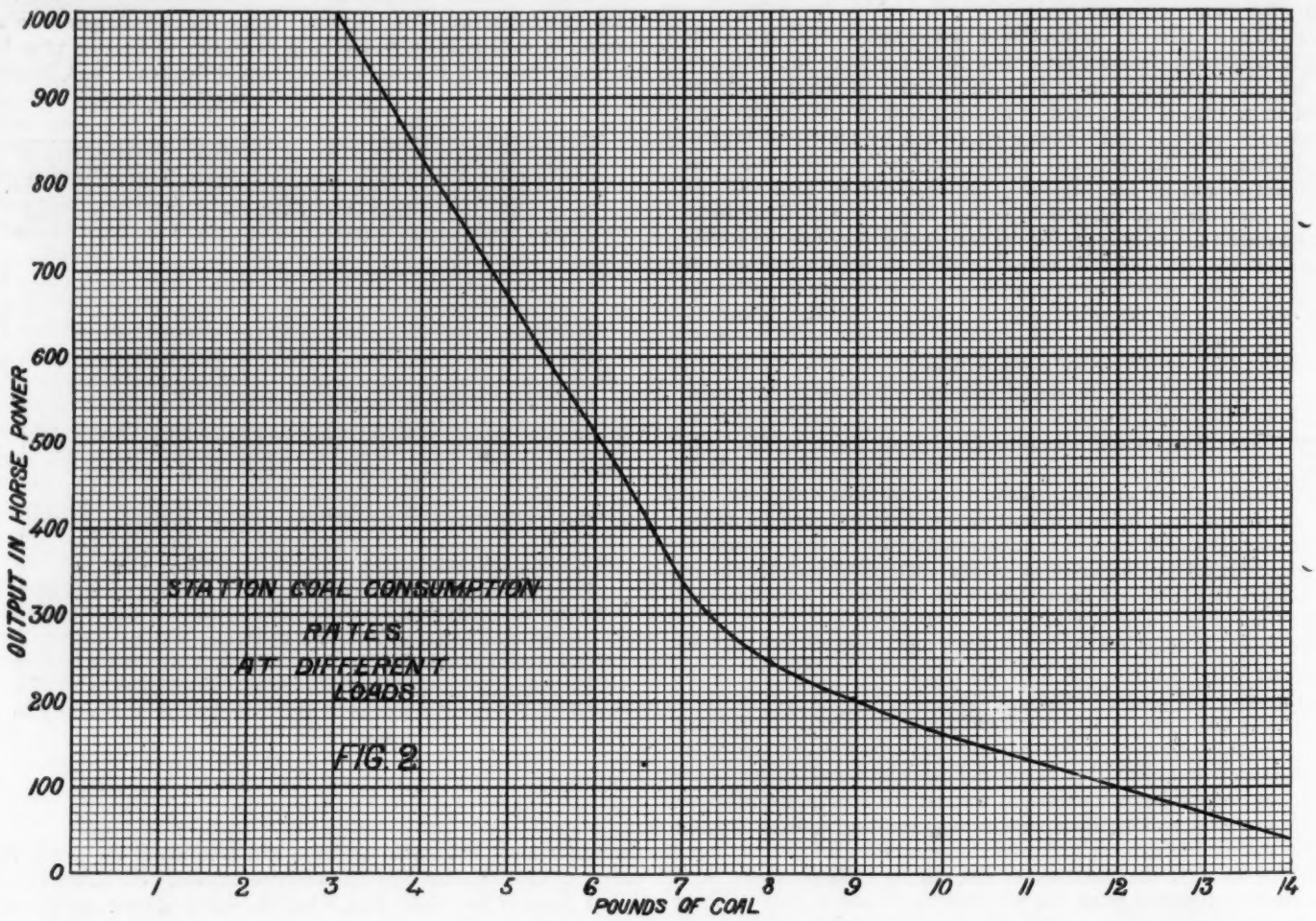


FIG. 2.—EFFICIENCY CURVE.

engine losses, and the steam used for the vacuum pump will take that shown by the upper curve, 7800 lbs. per day additional coal, or, say, 3½ tons.

For attendance to the steam-heating plant for the first heating season of 150 days, there should be a man at $2 per day. A piping plant within a radius of 1000 ft. of the station, including two mains, the return system, oil separators for steam and vacuum pump, could be erected for about $35,000. This brings the charges against this plant as follows:

Interest on capital, $35,000 6 per cent.....	$2100
Taxes	350
Depreciation	700
Labor	300
Coal at $3.00—325 tons.....	1575
	$5025

The heating surface that can be contracted for will be what can be maintained at 80 deg. difference in temperature between the inside and the outside of a building. This will roughly require 1 cubic foot connected to the steam heating system during peak loads; and it is this arrangement which causes the small coal consumption at the heavy loads on the station, as shown in Fig. 1.

One advantage of the steam heating adjunct is that in cities where large buildings are erected the necessary steam heating plant involves a boiler and attendance. This is the turning point that encourages the introduction of the isolated plant idea. Such attractive figures can be presented for steam heating that the lighting and elevator load on the station follow. The franchise of a lighting company is not, as a rule, broad enough to cover a steam heating system; but this can be organized under a separate charter, the station selling this company the steam, which is best measured by the amount of drip returned from the heating system.

Dye houses and breweries are customers to which electric lighting companies have sold hot water and live and dead steam with profit.

This method of obtaining revenue has been successfully tried by a number of lighting plants. The application of this waste product would in many cases seem to afford a revenue where the location and operation of the station are favorable.

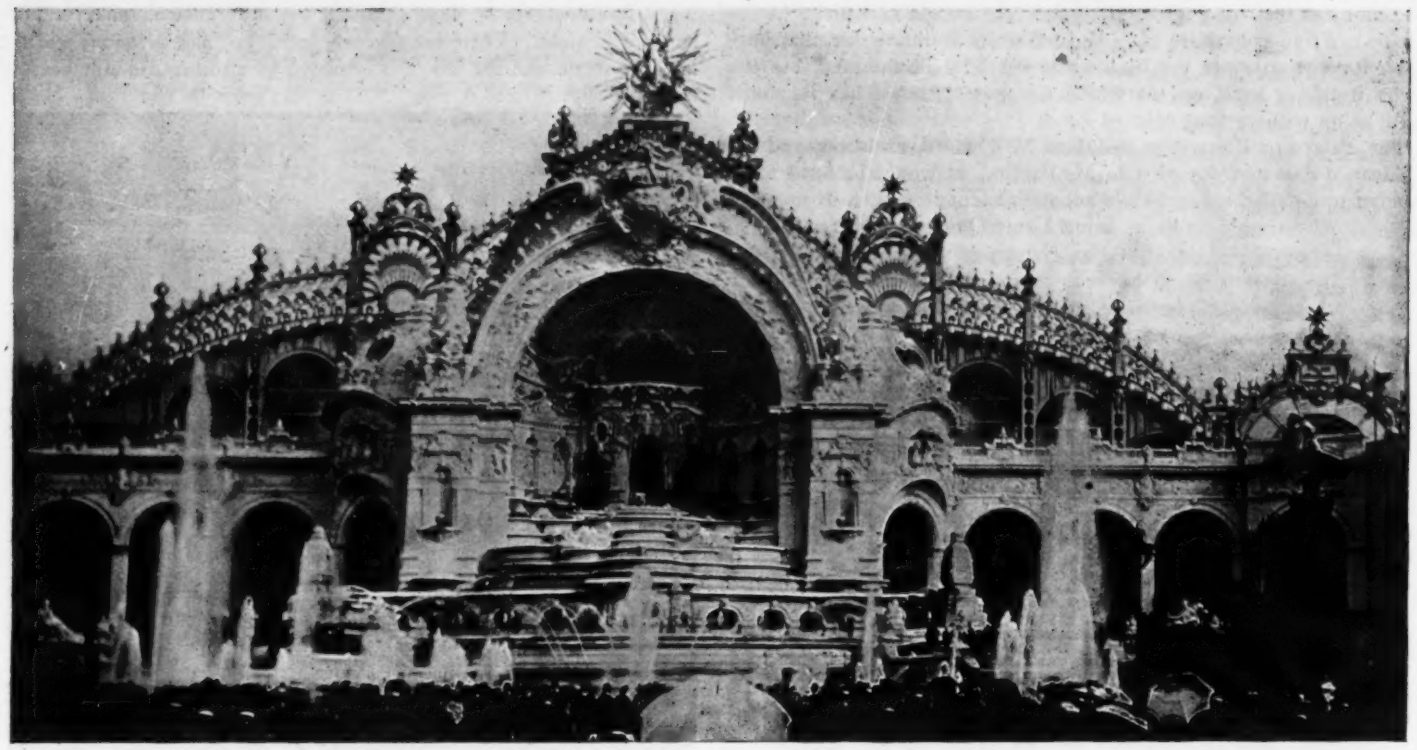


FIG. 1.—ELECTRICITY BUILDING, PARIS EXPOSITION, SHOWING FAÇADE FOR ILLUMINATION.

The Decorative Illumination of Electricity Building, Paris Exposition.

IT was not until well into June and the beginning of July that the decorative illuminations of the Paris Exposition were complete, but since that time night fêtes in the grounds have been frequently announced and have become favorite spectacles. On such fête nights every lamp that can be lit within the grounds is put in service and the trees everywhere are hung with a countless multitude of red paper Chinese lanterns; the Midway, known as the Rue de Paris, having several hundred colored incandescents fastened among the tree boughs. The Monumental Gate, on the Place de la Concorde, is lit up with hundreds of incandescents; the Trocadero Palace is festooned with thousands of gas jets, and all its fountains play; and all the Exposition buildings proper are outlined in electric lights or gas jets. This again is supplemented by the profuse lighting of most of the buildings on the Street of Nations and of those under concession for restaurants and side-shows, while arc lamps and gas standards are alight all over the grounds, and half a dozen searchlights flash their beams in every direction. One of the features of novelty which may be mentioned in passing in this connection is the use of acetylene lighting along the banks of the Seine on either side of the new Alexander bridge. The lamps flicker as usual, but the decorative effect of the white light, burning in long loops and occasional clusters, is very pretty.

The main part of the decorative lighting is to be found, however, on the Champ de Mars, and the chief item in that is the façade of Electricity Building as it stretches across the end of the long vista seen from the Trocadero, and extends behind the Château d'Eau, joining the Palace of Mechanics on the one side with the Palace of Chemistry on the other, and masking entirely from view the boiler plant and Agricultural Building, in its rear. Its total length is nearly 1400 feet, but that part of it which is visible to the public and is therefore available for decorative illumination, is slightly over 500

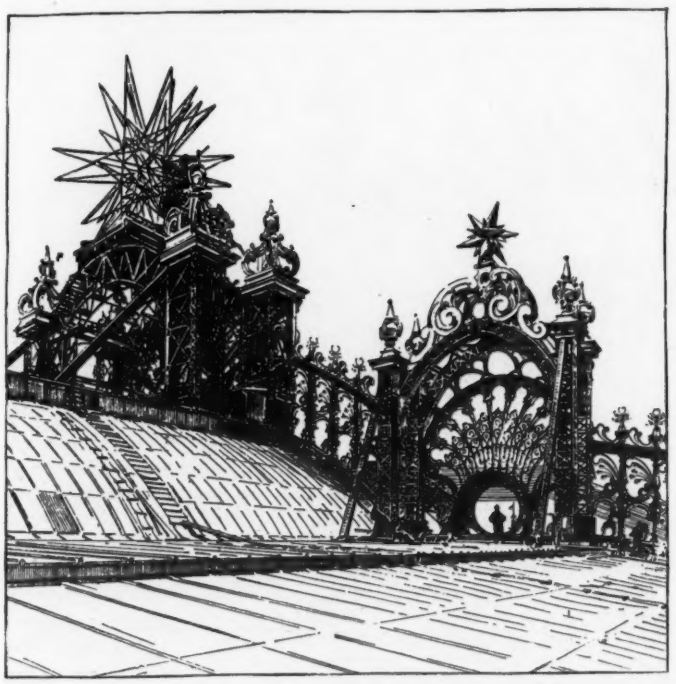


FIG. 2.—REAR OF FAÇADE.

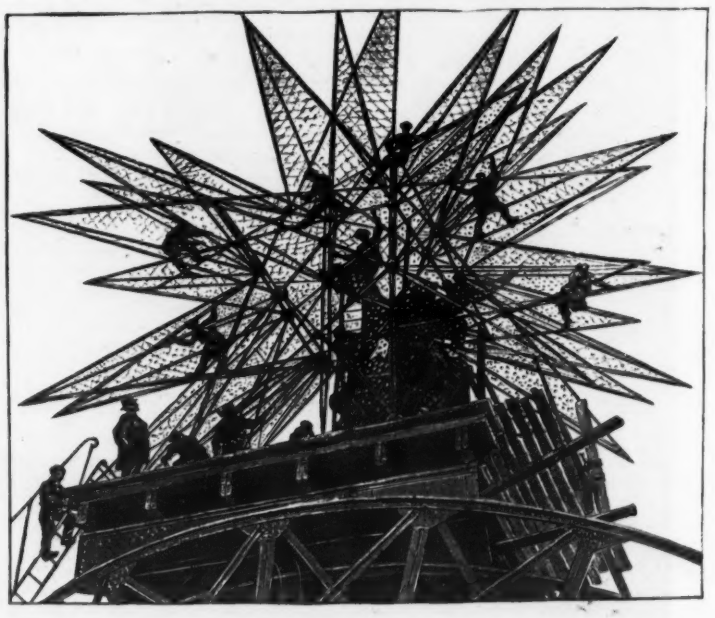


FIG. 3.—THE GREAT STAR.

feet in width (Fig. 1), and it has a height to the crest of its star of about 230 feet. As a matter of fact, the façade and niche of the Château d'Eau constitute part of Electricity Building for this purpose, for not only are the basins and cascades illuminated, but the niche itself, or arch, out of which the water jumps, has its dome fully lit up with various colored lamps.

The Palace of Electricity is due to M. Henard, architect, and the Château d'Eau in front of it to M. Paulin. It would be hard for a layman to define the florid style adopted, but it is spoken of by some of those who should know as being Louis Quinze. The result is to

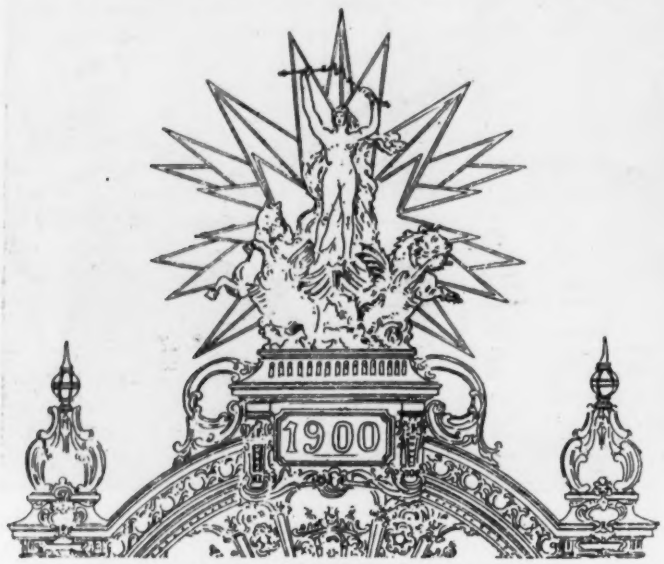


FIG. 4.—GENIUS OF ELECTRICITY WITH ELECTRODES.

d'Eau in front of it is wholly in creamy white stone and staff, offering a fine contrast by day, although the difference in material disappears at night. There are several "motives" and divisions worked into the front, and the whole is crowned by an immense star bearing

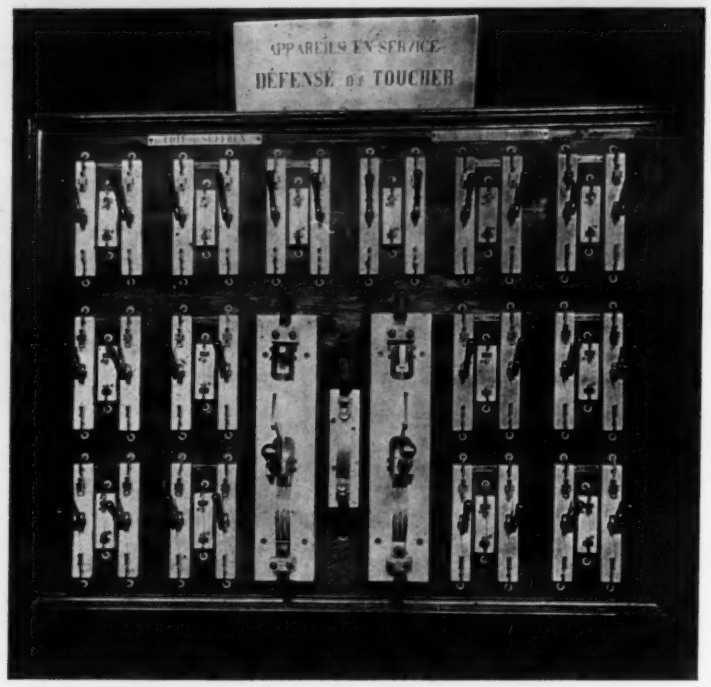


FIG. 5.—SWITCHBOARD IN SALON D'HONNEUR, ELECTRICITY BUILDING.

give the front of Electricity Building a very light and graceful appearance, not at all unlike an open fan or a border-pattern in lace (Fig. 6). It is entirely in glass, zinc and steel, while the Château

apparently a number of incandescents on a framework, and by a group of arcs, which throw their beams on the car of the Genius of Electricity so as to bring it out in high relief. Just below the tri-

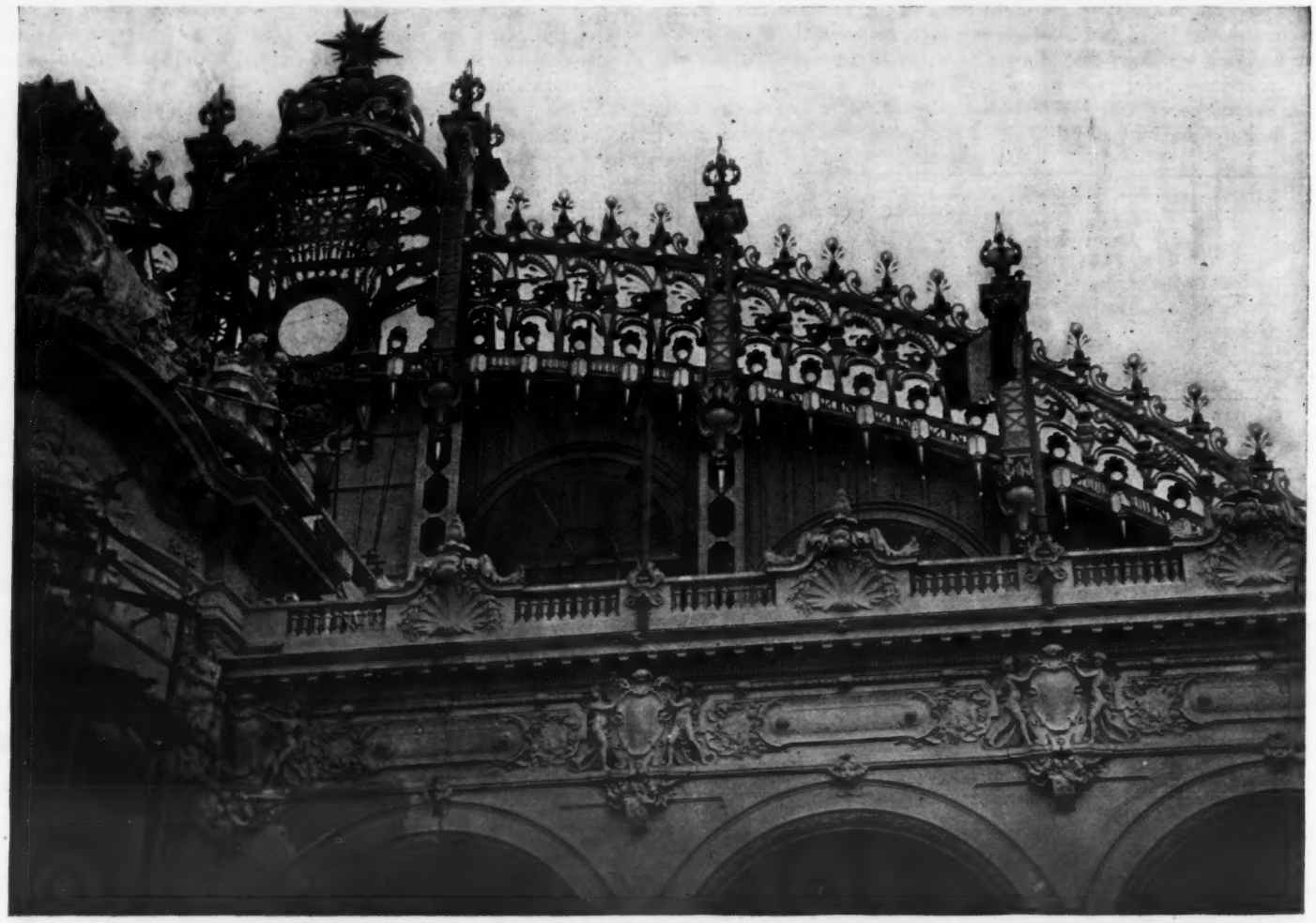
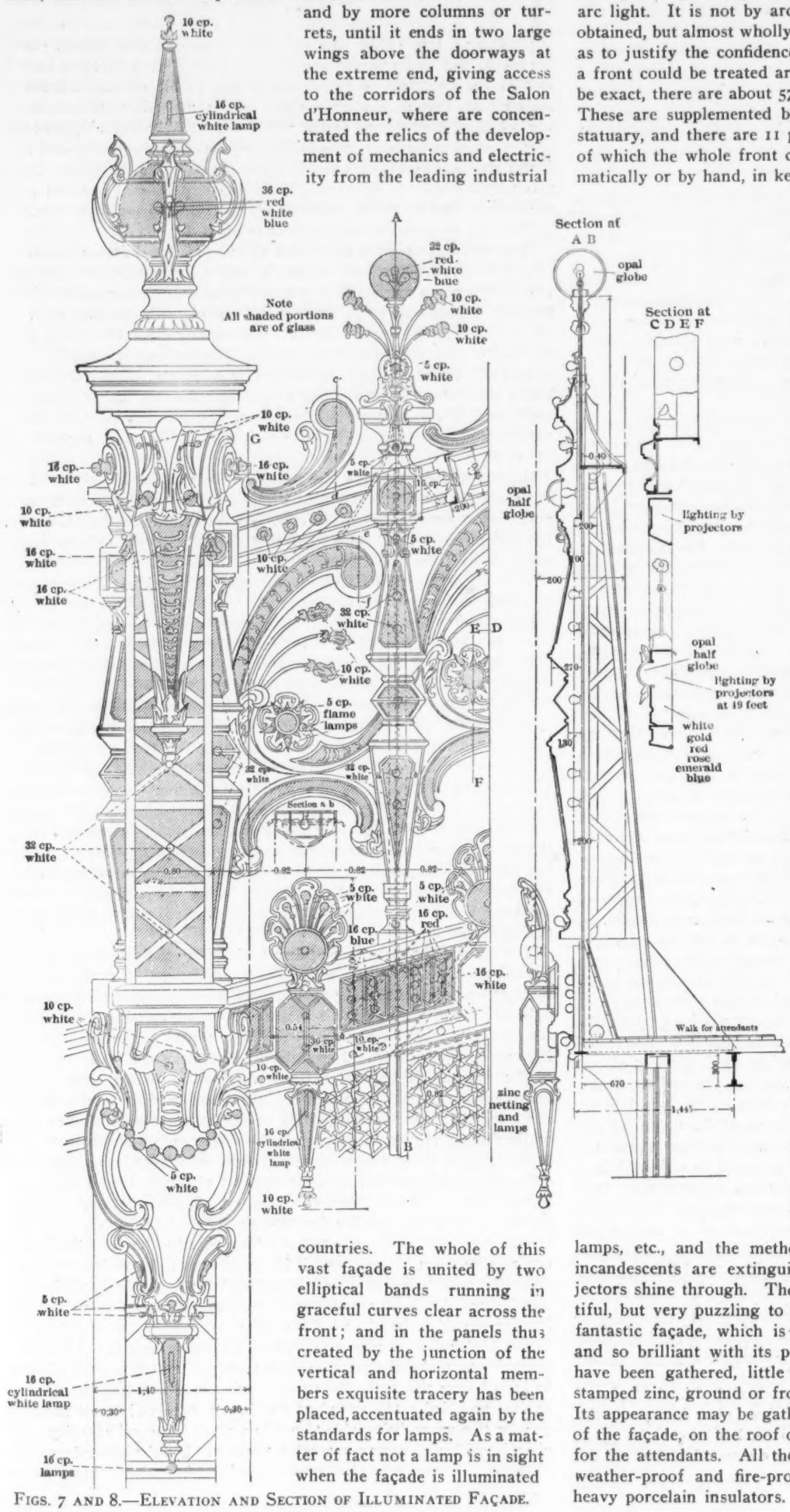


FIG. 6.—CREST OF ELECTRICITY BUILDING AND CHÂTEAU D'EAU.

umphal chariot of the Genius is a large panel with the date 1900 picked out in 100 incandescent lamps.

On each side of the main group are columns, as piers of the arch, and as the crest slopes it is cut by another dome, each way, and by more columns or turrets, until it ends in two large wings above the doorways at the extreme end, giving access to the corridors of the Salon d'Honneur, where are concentrated the relics of the development of mechanics and electricity from the leading industrial countries. The whole of this vast façade is united by two elliptical bands running in graceful curves clear across the front; and in the panels thus created by the junction of the vertical and horizontal members exquisite tracery has been placed, accentuated again by the standards for lamps. As a matter of fact not a lamp is in sight when the façade is illuminated except those in the date and in the tablet "R. F." on the Château; and one is likely, seeing the Palace of Electricity by day, to derive the natural idea that its front is lit by arcs, as the frosted glass panes and opal lamps and globes are large enough to conceal any ordinary arc light. It is not by arcs, however, that the beautiful effects are obtained, but almost wholly by incandescents, and the results are such as to justify the confidence of those who believed that so immense a front could be treated artistically and effectively in that way. To be exact, there are about 5700 incandescent lamps used for the front. These are supplemented by the 6 arcs placed behind the group of statuary, and there are 11 projectors with colored screens, by means of which the whole front can be changed in color at any time automatically or by hand, in keeping with the luminous fountains below, or quite independently. All the incandescent lamps, as well as the projectors, are manipulated from a central switchboard in Electricity Building.



FIGS. 7 AND 8.—ELEVATION AND SECTION OF ILLUMINATED FAÇADE.

The incandescent lamps are distributed mainly as follows: 2000 on the two main horizontal or elliptical lines of the front; 350 at each extreme end; 400 in each of the sections on either side of the central part, and 800 in the central part. There are also some 350 in various separate pieces and fixtures. These lamps are of 10, 16 and 32 cp. In the large globes and lanterns, lamps of 32 cp are used, as well as wherever a large surface of glass is exposed to view. The smallest lamps, of 5 and 10 cp, are employed chiefly to get the effect of strings of beads or gems, and some of the 10's are used in the flower-head bulbs, which stand out on stems in relief from the main mass. Provision is also made for the light of the projectors as it strikes through the transparent front of the building, there being glass panels and globes for that purpose, the colors used for projection being white, gold, red, rose, green and blue. The incandescent lamps are in three colors—red, white and blue—and when one color is switched in at the board, the other two lamps of the group are switched out. There are five groups of these corresponding to the five vertical divisions of the front itself. Lamps of ordinary form are chiefly used, but there are some cylindrical "taper" ones where the panel to be illuminated is long. The colors on the façade are as a rule not changed very quickly except with regard to the projectors, but after a new effect is obtained it is allowed to stay for two or three minutes until the eye has become accustomed to it; when another effect is given.

The details thus noted are brought out very clearly in Figs. 7 and 8, which show a portion of the front in elevation and section, indicating the portions that are in glass, the position and candle-power of the lamps, etc., and the method in which, when some or all of the incandescents are extinguished, the colored beams from the projectors shine through. The effects obtained are not only very beautiful, but very puzzling to the uninitiated. Seen from the rear, the fantastic façade, which is so soft in its cream and white by day and so brilliant with its polychromatic effects by night, is, as will have been gathered, little more than a stout, solid scaffolding of stamped zinc, ground or frosted glass, and wooden or steel supports. Its appearance may be gathered from Fig. 2, which shows the rear of the façade, on the roof of the Electricity Building, with the walk for the attendants. All the circuits there are also aerial, in special weather-proof and fire-proof wire and cable, and are carried on heavy porcelain insulators.

One special feature is the great central star at the crest, placed immediately behind the nude figure by Marqueste, of the Genius of Electricity, in the triumphal car drawn by a dragon and a pegasus. This figure is over 21 feet in height. The happy idea was hit upon of constructing the star in open work instead of solid or flat. It is formed of gilded tubing and has a total weight of 6½ tons. It was built up in sections of tubing, as shown by Fig. 3, and has 38 points, being in the form of an icosahedron, and having a diameter of not less than 49 feet. When the light of the six arc lamps concealed behind this star strike through the lattice panels, a curious glistening effect is seen. This is obtained from flint glass flowers placed on the panels, which glitter in the white light. The arc lamps are grouped two in series and are 60 amperes each.

The projectors are placed about 50 feet back on the roof of Electricity Building. There are 11 of them, all told, of 80 amperes each, and 10 of them are grouped in pairs in series. The changes of color are effected by means of glass screens placed before the light. The colors are different for each projector at any one moment, and the color screens are all manipulated by means of a metal cable, controlling their operation relatively to the others. The color changes thus go on steadily each side of the central motive, with a rainbow play that can be seen by all the hundreds of thousands of spectators grouped in the huge quadrangle all the way back to the Eiffel Tower and up the slopes of the Trocadero.

In connection with the central figure of the Genius of Electricity a charming effect has been proposed by Dr. d'Arsonval. It will be seen from Fig. 4 that she holds aloft two electrodes, between which a spark is supposed to be jumping. His idea is that this should be an actual spark, and he has studied and worked out different apparatus for this effect. In one instance he employs a condenser charged by a high-pressure alternating current transformer. The transformer is of 30-kw size, and of the closed magnetic circuit type, and receives current at 110 volts or 55 volts, and 42.5 periods per second, transforming up to a maximum of 90,000 volts. The condenser is formed of plants of micanite, 2 mm thick and measuring 365 x 285 mm, sandwiched between sheets of tin-plate, the micanite extending 5 cm over the edge of the metal, and the whole being plunged in petroleum. Twenty plates are used, and the capacity is about 0.01 microfarad. An ingenious discharger constructed by M. d'Arsonval consists of two metal spheres made to revolve in a circle in such a way that the current of air formed blows out the spark, and increases its length and noisiness, while if the speed of rotation is regulated so that the path moved through between two discharges is equal to the length of each spark, a continuous ring of fire is produced. As a spark up to 20 cm in length can be obtained by charging the condenser with 50,000 volts, and 600 discharges per second can be produced, 60 discharges can be seen in a tenth of a second, which gives the impression of a spark 1.20 metres in length. When the notes were taken for this article the apparatus had not been put in operation.

At first it was intended to use direct current at 220 volts for this lighting, but it was found more convenient to employ three-phase current at 2200 volts taken through the main service switchboard, described in a previous article and delivered to five transformers of 50 kw, three of 40 kw and one of 20 kw, making 390 kw of available current. Thence the circuits run up one of the large hollow columns of Electricity Building to the switchboard on the roof, 165 feet above. The cables and wires then go out to the various parts of the front.

All this work has been admirably carried out by M. Henri Beau, of Paris, who also has had in hand the lighting of the Salon d'Honneur section of Electricity Building, where direct current at 200-220 volts is used for 28 lusters of 4 arc lamps grouped in series. These lusters are of curious appearance, being formed apparently of rope with wooden cross-bars, from which the lamps depend. This lighting is very effective, but is, of course, supplemented by that of the various countries in their own courts. The circuits for these 112 arcs are grouped on a switchboard, as shown in Fig. 5, which is placed immediately in front of the hollow column up which pass all the alternating current cables for lighting the front. There are also special circuits, one of 100 lamps for the motive "1900," one of about 70 lamps for the "R. F." and one of some 200 lamps for the colored lamps in the "grotto" of the Château d'Eau.

As a matter of fact, the 5700 incandescents employed in the "crest" of Electricity Building do not include all whose glow is seen by the spectator, as there are 1500 others distributed all over the great niche or archway of the Château d'Eau and concealed within the recesses formed by the architecture, so as to serve as "defining" illumination.

High Voltage Incandescent Lamps.

By Prof. Geo. D. Shepardson.

THE high-voltage (200 to 250 volts) incandescent lamp made its first appearance about 1892, and in a short time won for itself quite a large place in commercial practice. For several years the merits and faults of the new product were given prominent attention in the electrical journals and in less public discussions, some maintaining that such a lamp could obtain little, if any, successful use, while others believed that it would immediately find a wide adoption. As the years have passed, the lamp has been improved and has found an ever-increasing use. For about two years the papers have given but little attention to this lamp, apparently for the reason that the novelty has worn off, while the lamp makers have been steadily and quietly at work improving their product.

In attempting to get a clear view of the present situation, it is desirable to recall the reasons originally urged for and against the 220-volt lamp and to inquire into the results of later development. The principal reasons urged in favor of its use were the smaller amount of copper required for conductors, the steadier light obtainable and the ability to reach greater distances. The reasons against it were principally that the lamps were of low efficiency, thus requiring a larger generating plant and more fuel, and that the lamps were not uniform. These reasons might be amplified indefinitely to cover various conditions, examples of which may be found in a paper by the writer.*

During recent years the lamp makers have added largely to their experience in making high-voltage lamps, so that they now turn out a much better product than formerly. At the same time their business has increased to such an extent that they are better able to select lamps to suit the requirements of each customer, thus doing away with much of the earlier lack of uniformity. The growth in the 220-volt lamp industry is illustrated by the fact that one firm, which sells about 75,000 lamps annually in Minnesota and adjoining States, reports that its sales are about equally divided between 110 and 220-volt lamps, most of the 110-volt lamps going to isolated plants, while practically all of the 220-volt lamps go to central stations.

The growth in the number of central stations using 220-volt lamps is indicated by the fact that the Powers Directory for October, 1894, listed 3 central stations in Minnesota using the 110-volt system, 11 using the 110-110-volt three-wire system, 1 using the 440-volt five-wire system and 29 using the alternating-current system. At the present time there are 9 stations using the 110-volt two-wire direct-current system, 17 using the 110-110-volt three-wire system, 38 using the 220-volt two-wire system, and 54 using alternating systems. During less than six years there have therefore been installed in Minnesota approximately 38 central stations using the 220-volt two-wire system, 6 using the 110-110-volt three-wire system and 25 using alternating systems.

The above figures are to be taken with some caution when comparing the relative advantages of the different systems, since they do not by any means prove that the 220-volt two-wire system is so far preferable to the 110-110-volt three-wire or to the alternating-current systems as might at first appear. The larger towns, for which alternating-current systems would seem best adapted, were already supplied.

The patents on the 110-110-volt three-wire system were in the hands of one company, so that engineers hesitated to specify it, and at contract lettings there was only one company to push that system, while there were numbers urging their alternating or 220-volt systems. Again, there are certain engineers who have learned how to draw plans and specifications for 220-volt plants, but who feel loath to undertake to plan a three-wire or alternating-current system; they therefore invariably call for the 220-volt system, whether that is really best or not, like the Chinese tailor, who claimed to have received only one pattern from his god, and if his customers did not fit suits made after that pattern it was their misfortune. On the other hand, it must be admitted that most owners and customers of plants using 220-volt lamps are well satisfied with the results.

The high price of copper prevailing for some time past has had a tendency to make the alternating-current system somewhat cheaper to install than the 220-volt system, so that one well-known engineer has not specified a 220-volt plant for three years and has not installed one for two years, being able to put in a plant for equal capacity more cheaply with alternating-current apparatus. On the other hand, the high cost of copper has led others to adopt 220 volts in cases where

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110 volts would have been preferable with lower prices for copper. The large number of 220-volt central station plants installed in Minnesota and adjoining States in recent years is due partly to the high price of copper, partly to a weakness of some designing engineers already noted, partly to the desire of the owners to get in a plant as cheaply as possible, hoping that the future would take care of itself. Many hope that in installing an electric light plant they can follow the practice of the railroads which put in cheap construction at first, and then from the profits of operation gradually substitute culverts and fills for piling and trestles, iron and stone bridges for wooden structures, short cut-offs for long detours, etc. Such practice is possible to a limited extent in the construction and operation of a lighting plant, but having once adopted a system, it can be changed but little except in the way of additions without throwing it away in part or whole.

When the 220-volt lamp was first introduced and its weak points were recognized, it was claimed by many that any improvements that might be made in the high-voltage lamp would apply equally well to the low-voltage lamp, so that the former would continue to require 20 to 40 per cent more watts per candle than the latter. The greatest difficulty seemed to be in the filament. Since a 220-volt lamp must have approximately four times the resistance of a 110-volt lamp of the same candle-power, in order that an equal amount of energy may be taken at double the voltage, its filament much be of only one-fourth the sectional area, or it must be four times as long, or some compromise between the two. A lamp with a short, thick filament can be operated at a higher efficiency than one with a long, thin filament, since the efficiency increases with the temperature, and a short, thick filament continues stable at a higher temperature than is safe for a long, thin one. The 110-volt lamp can thus be made more efficient than the 220-volt lamp, for the same reason that a large lamp is more efficient than a small one. Theoretically, the above is true, but not in its practical working out. The 110-volt lamp was already a commercial success, giving such satisfaction that consumers had little reason for demanding further improvement. On the other hand, the 220-volt lamp was unsatisfactory and, at the same time, there was a rapidly increasing demand for more and better lamps for 220-volt circuits. The natural result was that lamp makers gave more attention to improving the one than the other. The trouble with the high-voltage lamp was not only with the slender filament, but with its mounting, the globe and the vacuum. It was commonly found that if a high-voltage lamp burned a few hours without breaking, it was good for thousands of hours of tolerably satisfactory service.

The improvement in high-voltage lamps may be inferred from a test recently made in a central station, details of accuracy not given; 220-volt lamps of one maker fell from 15.5 initial candle-power to 15.0 candle-power at the end of 700 hours, with an average efficiency of 4.09 watts per candle; the trend of the curve indicating a probable life of about 4000 hours before falling below 80 per cent of initial nominal candle-power. Lamps of another make started at 15.25 candle-power and fell to 13.5 candle-power at the end of 700 hours, the average efficiency being 4.13 watts per candle, the curve indicating a probable useful life of 1000 hours. This test, if reliable, certainly indicates a great improvement over the lamps tested by the writer in 1897.† Not only have the efficiency and reliability of the 220-volt lamp improved, but it is made in various sizes as small as 8 candle-power, and the price has fallen until it costs only about one-tenth more than a similar 110-volt lamp, as against one-fourth more two years ago, 110-volt lamps now selling at 18 cents each in barrel lots of 200 to 250, while 220-volt lamps sell at 20 cents in barrel lots.

It is difficult to make a fair comparison between high and low-voltage lamps, because of the different conditions under which they are used. Considering the lamp alone, a fair test could be made by burning a number of lamps for 110 and 220 volts at different efficiencies and then finding the life curves which had the same general characteristics. A 110-volt lamp operated at a certain efficiency might then be compared with a 220-volt lamp burned at such an efficiency that its candle-power dropped off at about the same rate as the 110-volt lamp. Another basis of comparison would be to note the ratio of annual lamp renewals to total number of lamps installed in various stations, and then compare the efficiencies of lamps when the ratio for a 110-volt plant is found to be the same as that for a 220-volt plant. The latter would seem to be the more correct method were it not for the fact that most of the 220-volt plants have been installed recently and the circuits are presumably designed for approximately the present actual load, while the stations using 110-volt lamps have usually been in operation for a number of years, and the circuits are likely to be not only overloaded, but also unsymmetrically loaded, so that the range of voltage is much worse, even allowing that the voltage at the main centre of distribution is regulated as closely as in the 220-volt plant. In such a test the "personal equation" of the plants is a large factor, the layout of the circuits, distribution of load, regulation of dynamos and the practice in replacing old unbroken lamps affecting the results.

It is, therefore, not surprising that different lamp agents make varying claims in comparing 110 and 220-volt lamps from their own factories. One lamp agent holds that his 4.4-watt 220-volt lamp is the peer of his 3.5-watt 110-volt lamp; another says his 4-watt and 3.5-watt lamps are comparable; another claims his 3.8-watt 220-volt lamp is the equal of his 3.5-watt 110-volt lamp; still another believes that his 4-watt 220-volt lamp is the peer of his 4-watt 110-volt lamp, giving as proof the fact that a station using his 3.6-watt 110-volt lamps buys annually as many lamp renewals as there are lamps installed, while another station using 220-volt lamps buys only one-third that proportion of renewals.

In comparing the performance of incandescent lamps, it is necessary to consider a number of conditions that materially modify the conclusions that might be drawn from accurate tests conducted under laboratory conditions.

In the actual practice of the small (not excluding many of the large) central stations, the variation of voltage is such as to require the use of low-efficiency lamps. It is well understood by engineers, although not sufficiently appreciated by owners and operators, that fluctuations of voltage affect the candle-power and life of high-efficiency lamps far more than those of low-efficiency lamps. Owners and operators do not usually realize how rapidly an excessive voltage decreases both the life and the candle-power of incandescent lamps. In the smaller plants especially, the man in charge of the dynamo has so many other duties that he does not keep close watch of the voltmeter, and the voltage is frequently so high as to cause an excessive lamp breakage unless the lamps are of low efficiency. In a surprising number of plants the voltmeter is of poor construction or is even entirely absent, so that the operator governs the pressure entirely by his eye, keeping the lamps "about right." In one case complaint came that the 3.1-watt lamps furnished were of poor quality, and investigation showed that the 110-volt lamps were being operated at 130 volts, so that it was no wonder that some of them lasted only six hours.

Even when the operator appreciates the importance of maintaining the voltage constant, it frequently occurs that the voltmeter is connected to the circuits at the power house, rather than at the main centre of distribution, so that while the pressure may remain reasonably constant at the power house, it rises excessively at distant points when the load drops off. One customer of a comparatively large station reported that his voltage varied from 90 to 120 volts at different hours of the day. In the ordinary lighting system the distributing circuits are so laid out that the drop from the main centre of distribution to the farther lamps is so great as to cause extreme variations of voltage. This poor design and construction of circuits is due to four reasons: The wretched work of poorly-prepared men who pose as electrical engineers; the limited amount of money available for conductors; the desire to make the least money cover the largest possible territory, and the unsymmetrical overloading of the circuits as business grows. The result of all these conditions is that the voltage varies to such an extent that only a low-efficiency lamp will give satisfaction in the average central station. High-efficiency lamps requiring 3.1 watts per candle are used successfully in plants where the conducting system and the operation of the station are such as to insure close regulation of voltage at the lamps within about 3 per cent.

As was so well brought out in J. W. Howell's classic paper on "The Maximum Efficiency of Incandescent Lamps," before the American Institute of Electrical Engineers in May, 1888,‡ the lamps should be operated at such a voltage and efficiency that the total cost of operation, including fuel, lamp renewals, and all other costs, should be a minimum. The difficulty with the practical application of this simple rule is that some of the elements of cost are easily recognized, while others are not so easily discerned. Without the aid of skilled electrical engineers, it is difficult to analyze accurately the elements of the total cost of electric light. The cost of lamp renewals is an element that is patent on the bills, and the vast majority of plant owners wish to see such items reduced to the minimum, so they continue to demand lamps giving long life. The customers of central stations

†See Proceedings Northwestern Electrical Association, 1897, pages 18 to 29 and 47 to 58; also *Elec. World*, XXX: 120; Lond. *Elec. Rev.*, XLI: 233, etc.

‡*Elec. World*, XI: 190.

also desire lamps of long life, to avoid interruption of service by lamp breakage and to reduce the charges for new lamps. Of course, where current is paid for by meter, the station operator does not object if his customers desire long-life lamps, since the latter do not appreciate their effect upon the meter bills.

As a result of the above causes, the lamp supply people have learned that for the average station 3.1-watt lamps are not at all satisfactory, 3.5-watt lamps give better results, but the people seem to be pleased still better with lamps requiring about 4 watts per candle. The 220-volt lamp has therefore to compete not with the 3.1-watt lamp, but rather with one requiring 3.5 or 4 watts per candle.

Another item that lessens the relative disadvantage of the 220-volt lamp is the fact that the smallest size wire allowable on pole lines is governed not by minimum allowable conductivity, but rather by minimum allowable mechanical strength. Good practice does not permit any copper wire smaller than No. 10 B. & S. G. to be used on outside construction (this limit not applying to wires in cables or to hard-drawn bare conductors such as are used in telephone work). No. 10 wire is used to a large extent for small mains on 110-volt circuits, and naturally therein occurs a considerable portion of the total drop on the line at times of heavy load. When the pressure is doubled and 220-volt lamps are used instead of 110-volt, the current on the line is nearly halved, and therefore the drop is also halved, while the percentage drop is only one-fourth. For example, suppose on a certain circuit that 110-volt lamps take a current of 10 amperes, entailing a drop of 2.2 volts in the part of the line which consists of No. 10 wire; now, if the pressure be raised and 220-volt lamps be substituted, the current will be approximately 5 amperes, the drop will be then only 1.1 volt. In the first case the drop is 2 per cent of the lamp voltage, while in the second it is only one-half of 1 per cent. The result is that, assuming equally good regulation of voltage at the main centre of distribution, the relative fluctuations in different parts of the system will be much less with 220-volt lamps than with 110-volt lamps. This general conclusion is true, even allowing the efficiency of 220 volts to be considerably less than that of 110-volt lamps, making the current at 220 volts sensibly more than half that at 110 volts.

It has been urged with good reason against the use of 220-volt lamps that their low efficiency requires a larger investment in generators and other station equipment for an equal lighting capacity. This is doubtless true, and should be given full consideration, especially in the case of a municipal or an isolated plant where the user of the lights is also the owner of the plant. In the case of the central station for general supply, however, the financial interests do not lie immediately in the same direction. It is coming to be more and more common practice to sell current by meter rather than to furnish lights on flat rates. It is, therefore, to the interest of the station operator to sell as much current as possible, and the user of the lamps does not discern between the watt consumption of his 220-volt lamps and that of the 110-volt lamps in the neighboring town, except to feel sure that his lights are better. Therefore, both the station owner and the lamp user are satisfied.

A real difficulty with the 220-volt system lies in the increasing use of arc lamps. The enclosed arc lamp for use on 220-volt circuits draws a long arc, and therefore gives a light strongly tinged with violet. The color can be toned down by using opal glass for both inner and outer globes, but these greatly reduce the light, already too small. In many cases it is practicable to use two 110-volt enclosed arc lamps in series. While this practice is the general custom and is successful in many cases, yet it is apt to lead to trouble in the case of small plants whose operators are necessarily men of comparatively little electrical and engineering knowledge, and who have difficulty in understanding the adjustment of arc lamps so that two will work properly in series. This is especially true after one of the lamps has been repaired.

The conclusion is that the 220-volt lamp is a commercial success and is coming into more and more extensive use. The intelligent engineer will recognize, however, that each system has its own field. In some places the 110-volt system is best; in others the 220-volt three-wire system is best; in others nothing is suitable except the alternating-current system with transformers. Under certain conditions the 220-volt two-wire system, or the 440-volt three-wire system may compete successfully, and should be considered with great care before the engineer decides which system to recommend for a particular case.

International Physical Congress.

(From Our Special Correspondent.)

The final session of the International Physical Congress was held Sunday morning, Aug. 12, at which President Cornu in a parting address referred to the great value to science of the large number of papers presented, many of which will long hold the place of monographs giving the state at the end of the century of the particular branch of science treated. Prof. Warburg, of Germany; General Rykatcheff, of Russia, and Prof. A. G. Webster, of the United States, responded on behalf of the delegates, all referring in warm terms to many courtesies received.

Among the events of the congress week were a reception by the President of the French Republic on Friday afternoon and a reception by Prince Roland Bonaparte at his hotel on Saturday evening. The presidential reception was not confined to members of the Physical Congress, but was extended also to the members of the medical, mathematical and many other congresses sitting during the week, and the attendants at the international reunion of students. As a consequence, the crowd at the Eylsée was so great that the affair became a crush in which the ladies' toilets suffered more or less; and while the percentage of boors was probably small, yet by marshaling their strength they were able to take possession of the refreshment tables and otherwise render themselves obnoxious to a degree which made the occasion one not to be remembered with pleasure by those present.

On the other hand, the reception given by Prince Roland Bonaparte in his magnificent hotel in Avenue d'Iena was a brilliant success. About 500 guests were present, including members of the mathematical congress, of one section of which Prince Bonaparte was president. In the great library, consisting of two long wings united at one end by a transverse section, were exhibited many pieces of scientific apparatus, there being an attendant in most cases to operate the apparatus or explain its peculiarities. One of the notable exhibits was a fine Gaiffe induction coil with many accessories to illustrate the phenomena of electrical discharges.

Among the other notable events of the congress were the afternoon session, at which Lord Kelvin read and expounded his paper; a session at the Sorbonne, where Messrs. Becquerel and Curie gave demonstrations with radio-active substances; and a session at the Ecole Polytechnique, where President Cornu showed various apparatus which had been used in the determination of the velocity of light.

Among the personalities at the congress were the distinguished Eastern physicists, Prof. Nagaoka, of Japan, and Chunder Bose, of India—the latter accompanied by his wife in Indian costume. Mme. Curie, noted for her brilliant work in radio-activity, was secretary of one of the sections, and took a leading part in the discussion of units and notation. M. Curie, the husband, was one of the active members of the electrical section.

The sessions were mostly occupied in the reading of papers, there being few discussions. Following the reading of the paper by MM. Bichat and Swyngedauw on ultra-violet rays, a discussion ensued between M. Swyngedauw and Prof. Warburg, the former insisting on the influence of ultra-violet light in lengthening the sparking distance between the electrodes of an induction coil, while the latter considers that their effect is to retard the discharge. After the reading of the paper of Arrhenius on electrolytic dissociation of solutions, Prof. Nernst developed his theory of the primary battery. Prof. Lucien Poincaré pronounced this theory as dangerous in that its fundamentals are not sufficiently well established. Prof. Chunder Bose gave an account of his researches in coherers, which were referred to in the paper of Branly as the principal contribution to its theory, constituting a systematic study of the properties of many metals. At the conclusion of Prof. Bose's remarks, Prof. Weiss dwelt upon the importance of these researches which, he said, contained an entirely new method of investigation. Following the reading of Prof. Warburg's paper on hysteresis, Prof. Weiss proposed to reserve the name of hysteresis for the phenomena of lag on variables other than time, and the name "retard" for phenomena dependent on time alone.

The matter of units and notation came before the congress in the report of a committee before referred to, but no action was taken. Lack of action was probably due to the fact brought out by General Rykatcheff during the meeting of the committee that the members of the congress for the most part were not delegates appointed by governments or scientific bodies, and therefore the voice of the con-

gress could have no direct authority. We give below a résumé of the propositions brought before the committee.

M. de Rey-Pailhade proposed that the committee recommend the decimalization of time, but no action was taken. Mr. Guillaume proposed for the unit of pressure, the barie, or the pressure exerted by a column of mercury 75 cm high, the normal weight to be defined by the condition that this unit be equal to one megadyne per cm^2. M. Pellat considered that two points should be distinguished: first, the barie is defined as 10^6 c. g. s.; and second, it is represented by a column of mercury of 75 cm to define normal weight. Madame Curie remarked that the pressure 10^6 c. g. s. entered into no system, and proposed to call the c. g. s. unit the barie and to employ the prefixes mega, bimega, etc., for 10^6, 10^{12} c. g. s. MM. Pellat and Guillaume gave their support to this proposition. Prof. Pfaundler remarked that the proposition of M. Guillaume is in accord with the c. g. s. system used in thermodynamics. General Rykatcheff proposed for the unit of pressure the millimetre of mercury, but M. Guillaume entered the criticism that the coefficients of reduction would be too complicated. A demand for a vote having arisen, Prof. Thiesen considered that the question was not sufficiently matured, while on the other hand Prof. Webster insisted that the congress commit itself—at least to the principle. Finally, the committee adopted the following resolution:

1. That the barie be the unit of pressure—the quotient of the dyne by the cm^2.

2. That it is premature to define the intensity of weight; but it is desirable that geodicians furnish at an early day a collection of data to guide the selection of a value.

Mr. Guillaume offered the proposition that the unit of radiation ought to be related to the c. g. s. system, and especially that the solar constant should be expressed in watts per cm^2. After a discussion, in which MM. Guillaume, Thiesen, Vernon-Boys, Webster and Abraham joined, the committee adopted the resolution that it is recommended that the results of calorimetric experiments be expressed, first, in the system involved in the experiments; and second, in the c. g. s. system.

After some discussion, a third proposition of M. Guillaume was adopted, namely, that the employment is recommended of diagrams, using wave lengths to represent the distribution of energy in the spectrum, and the adoption of the logarithmic scale for all radiations from ultra-violet to electrical waves; and that the spectrum be divided into regions analogous to acoustic octaves, the regions being denoted by R, with successive negative subscripts toward the ultra-violet, and positive subscripts toward the infra-red.

Some discussion took place as to the advisability of giving a name to the unit wave length. M. Guillaume proposed the micron or the millimicron. M. Kayser favored the *angstroem,* or ten-thousandth of a micron, for the reason that it is a unit according with the length of waves. M. Perot preferred the micron as giving in most cases three figures, which are easier to retain. Prof. Langley said that he has always employed the angstroem. No vote was taken.

By vote it was decided not to be necessary to give the name "emissive power" to the constant of emissivity. It was recommended that authors represent local emissions by functions of λ and θ, which give superposed curves. It was also recommended that authors give complete diagrams of the distribution of energy.

In a discussion on a proposition that the violle or photometric unit be further defined by the statement that the surface of the platinum shall be free, Prof. Thiesen remarked that the unit violle would never be adopted in Germany. No action was taken on the proposition.

A proposal to give a name to the units of velocity and acceleration was favored by MM. Guillaume, Pellat, Ottingen and Webster, and opposed by Abraham, Vernon-Boys, and Kayser. The proposition was rejected by vote.

M. Hospitalier proposed a new nomenclature intended to do away with the term "specific," which term is now employed with many significations. Instead of "specific mass," for example, he would say "volumetric mass," the suffix "ic" indicating that the volume enters in the denominator. The proposition was not adopted. Prof. Webster expressed the opinion that the definition of Everett should be adopted, namely, that the density is the mass per unit volume. Upon vote this definition was adopted.

Following are abstracts of some of the papers read at the congress:

Lord Kelvin, in a paper "On the Movement of an Elastic Solid Traversed by a Body Acting on it by Attraction or Repulsion," returns to a consideration of the ether, and gives a conceivable explanation to a serious defect in the undulatory theory of light. The hypothesis assumes a movable atom surrounded by an immovable ether, and the treatment is highly mathematical. In fact, the author states that the problem is one of pure mathematics, but is made a subject of a paper for the Physical Congress on account of its bearing on the undulatory theory of light. The hypothesis also requires that the density of the ether at the centre of the atom shall be 100 times the density of the free ether. An objection to the hypothesis is noted in the fact that the experiments of Michaelson have shown the ether to be immovable with respect to the earth, which objection, however, may be met by the hypothesis of Lorentz that the movement of ether through matter may alter the linear dimensions, which invalidates the conclusions based upon Michaelson's experiment.

Prof. R. Blondlot and Dr. C. Gutton of the University of Nancy presented a paper giving a review of measurements made to determine the speed of propagation of electromagnetic waves. On Feb. 2, 1888, Hertz published his famous paper announcing a proof of the Maxwellian hypothesis that electromagnetic action is propagated in air at a speed of the same order as that of light. In 1891 Blondlot, after unsuccessful attempts by others, devised a method for measuring the velocity with some degree of precision, and obtained a figure according with the velocity of light, at the same time establishing experimentally that the velocity is independent of the length of the wave, as in the case of light. The same physicist devised a different method of measurement in 1893, and the methods are described which were employed by Trowbridge and Duane in 1895, Ebert in 1895, Saunders in 1897 and MacLean in 1899—the method of the latter being adversely criticized. A comparison shows a remarkable concordance of the figures obtained, which are practically equal to the velocity of light and the ratio between the electromagnetic and electrostatic systems of units. In conclusion Prof. Blondlot says that it is of capital interest to know if this equality is absolute or only approximate, and suggests that in future measurements of electrical waves not only should the greatest accuracy be secured, but the degree of approximation determined of the numbers arrived at.

Prof. G. Gouy of the University of Lyons presented a paper on "Standards of Electromotive Force," which is practically devoted to the sole consideration of the Clark type. The paper is an excellent résumé of present knowledge concerning the Clark cell, its construction, testing, etc. The conclusions of the author are that the superiority of the cadmium over the mercury type now appears well established, and that one is justified in the belief that that standard in connection with known resistances will in the future form the base of electrical measurements of precision until replaced by some new combination. The same degree of approximation in electrical measurement cannot be obtained with the silver voltameter, which besides is a much more delicate apparatus to use. At present the cadmium cell permits of an approximation of one ten-thousandth.

Prof. V. Bjerknes of the University of Stockholm contributed a paper in which is given a review of the work of his father, Prof. C. A. Bjerknes, of the University of Christiania, with respect to the theory of hydrodynamic action at a distance. These researches led to the discovery of remarkable analogies with the phenomena of static electricity and magnetism, thus supporting the theory of Faraday as to the important role of the medium in electrical and magnetic action. The paper is a résumé of an elaborate treatise on the subject by the author, recently printed in book form. Among the conclusions of the author are that the generalities resting upon the actions between spheres submerged in a liquid are completely analogous to those applying in the case of magnetic and electrical fields, except that they are inverted. Hydrodynamic phenomena, therefore, form an image of electrostatic and magnetic phenomena, which is exact in all of its details, but the image is a negative one like that in a mirror. An interesting deduction of the paper is that certain electrical and hydrodynamic formulas will be identical if the former are expressed in the rational units, proposed by Heaviside. Prof. Bjerknes condemns the present system of electrical units, saying that a similar system would be inadmissible in mechanical science, and concludes with the prediction that the reform of units proposed by Heaviside will be inevitable when the true nature of electrical quantities becomes known.

The Power Plant, American Machinery Hall, Vincennes.

The American Machinery Building, constructed by the Berlin Iron Bridge Co., and erected within an incredibly short space of time, provides accommodation for about 60 exhibitors. It has already been freely illustrated and described in these pages. The machinery being shown in actual operation, it was necessary to install a power plant, the transmission being, of course, electrical. For this purpose an addition was made to the building on the northern side, the engine room communicating directly with the main hall, and the boiler room alongside being enclosed in brick walls. Here are two Morrin Climax boilers of the vertical, water-tube type, built by the Clonbrock Boiler Co. They are each 250 hp, and are provided with four furnaces, which arrangement permits—in case of necessity—of cleaning one fire and still holding the pressure on the boiler. Steam pressure is maintained constant by a Kieley & Mueller improved Climax damper regulator, which automatically adjusts a damper in the flue above the boiler, regulating the draught according to the pressure of steam. Water is supplied to the boilers through a Blake-Knowles feed pump with compound cylinders 6x10 and 5x10, situated in a corner of the engine room. A Wainwright corrugated tube feed water heater is used, manufactured by the Taunton Locomotive Mfg. Co., of Taunton, Mass.

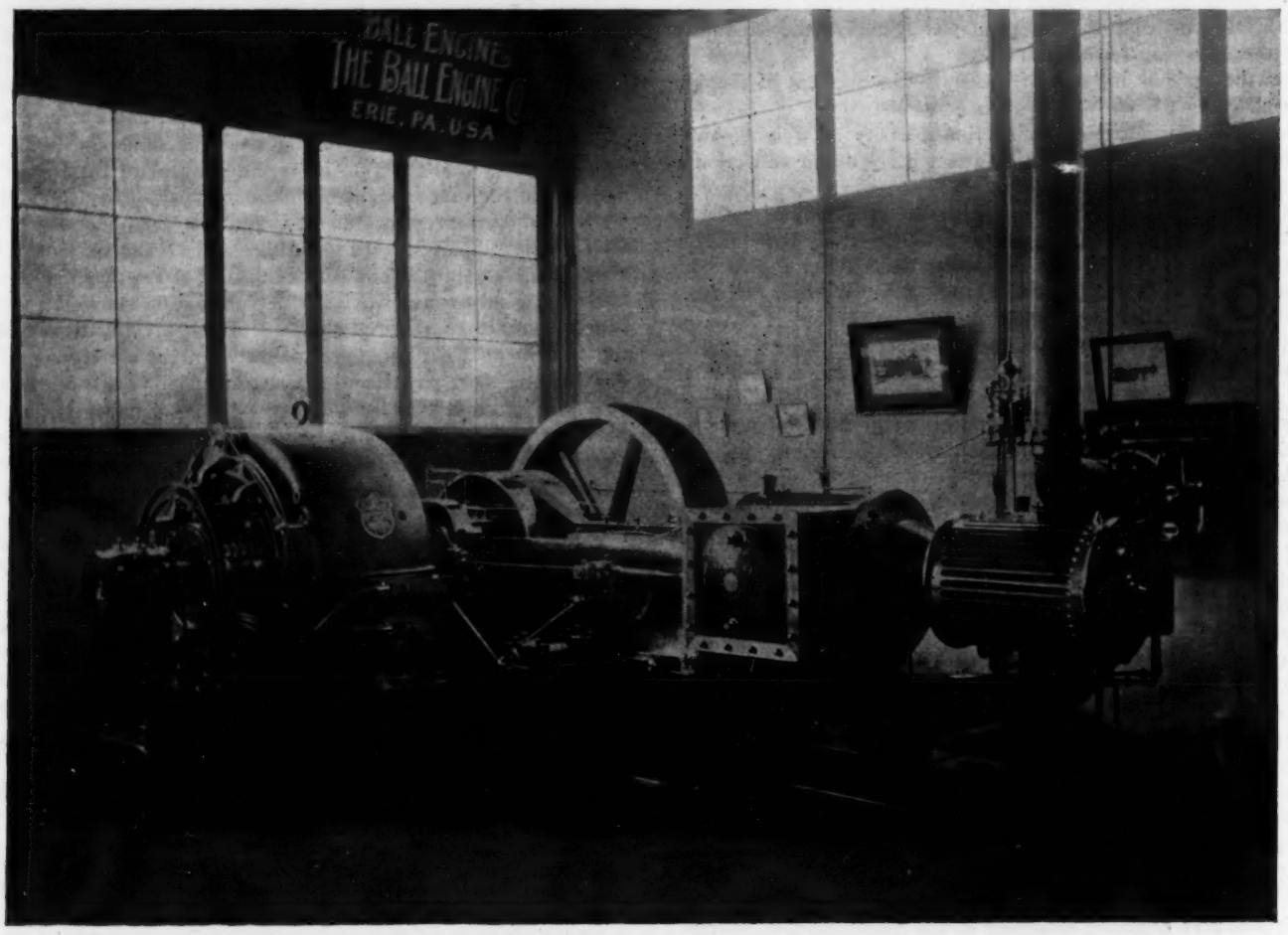


FIG. 1.—THE POWER PLANT OF THE AMERICAN MACHINERY HALL, VINCENNES.

The electric generating set consists of a 300-hp Ball horizontal tandem compound engine, with cylinders 15—25 x 18, built by the Ball Engine Co., of Erie, Pa., direct connected to a 200-kw Bullock generator. The steam pressure carried on the boilers is 250 lbs. This plant has been running only since July 1, for it will be remembered that a large part of the outfit was lost on the Pauillac, the crank shaft of the original engine and the smaller fittings, as well as the entire generator, having to be replaced. During this time a Willans temporary plant was used to operate the machinery and crane. The Ball engine is giving splendid service, and is upholding alone the honor of the country in this line, as it is the only American-built engine in the whole Exposition. There are many points of interest in the design of the engine, which, mounted on a sub-base extending under the cylinders, gives a solid appearance to the whole outfit. The steam chests of the two cylinders are on opposite sides, which permits the valve motions to be simplified. The valves themselves are very satisfactory in operation, being made in two parts, with a telescope joint, and held against the seat by steam pressure in such a way as to entirely prevent leakage of steam along the wearing surfaces. The divided head between the cylinders is a valuable arrangement, as the two pieces of which it is composed may be removed by taking out a few bolts. The strain is taken up by grooved and tongued joints, relieving the bolts entirely.

Direct connected to the engine is an 8-pole Bullock generator with cast-steel field and laminated pole pieces, furnishing current at 240 volts with no load, an over-compounding of 10 volts giving 250 volts at full load. The field excitation is, however, kept down so as to give 225 volts with normal load, as this is more suitable for some of the motors in the building. The average load is about 300 amperes, but runs up sometimes to 500 amperes. The brushes are of the well-known reaction type, firmly held on brush-holders electrically connected by two heavy bands of copper wound over with cord to prevent accidental short-circuiting. The connections to the series coils are heavy copper bars whose terminals are brought to a board fixed to the frame of the machine, the shunt terminals being on a second board. A very slow longitudinal motion is given to the brushes whereby they are moved along the face of the commutator, back and forth, the motion being derived from double worm gearing actuated by a belt from the shaft. The whole of the brush-holder yoke is moved in this manner. The frame suporting the motor is in one piece with the sub-base under the engine, making a solid unit of the whole set. Current from this generator is used chiefly for power purposes in connection with the operation of machine tools and the Shaw 30-ton crane which serves the building, but there are also a few lights run here and in the adjacent Transportation Building.

The marble switchboard was also provided by the Bullock Electric Co., but is furnished with instruments by various makers. The main switch is beautifully finished, with extra heavy double-knife blades and double contact. A small switch is provided for the generator field. The field rheostat was built by the Ward Leonard Electric Co., who have mounted behind the board three enamel discs in parallel, the handle projecting through to the face of the board

Weston station ammeter and voltmeters are provided, the former reading up to 1000 amperes and the latter to 300 volts. A circuit-breaker by the Cutter Electrical and Mfg. Co., double-pole type, set normally at 800 amperes, completes the list of instruments.

Regulation of the engine as to speed is as nearly perfect as possible with the inertia governor in the flywheel. In case of accident which should cause racing of the engine, or to provide means of shutting off the steam from a distance, a Monarch engine stop has been installed. This appliance is placed on the floor and belted to the shaft, a centrifugal mechanism being so arranged that any abnormal rise in speed will close a local battery circuit and energize an electro-magnet, causing it to release a weight which in descending closes the main steam valve. For stopping the engine from any distant point, wires are run through, and a push-button is conveniently placed.

This power plant will be the last piece of machinery to be removed from the United States Building after the close of the Exposition in November, as the traveling crane is dependent upon it for supply of power for loading the exhibits on the cars. That there will be an overwhelming and sudden demand for cars is, of course, certain,

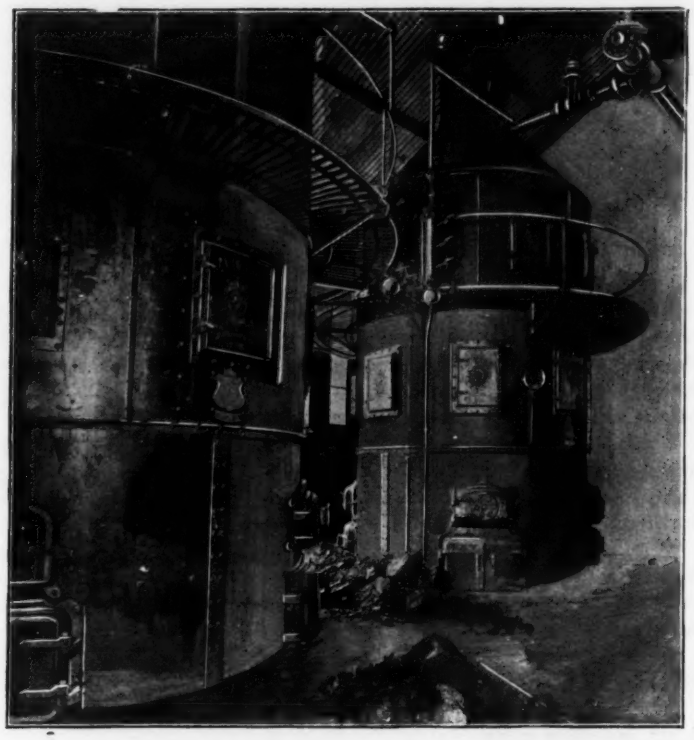


FIG. 2.—BOILER ROOM.

because everyone will want them at the same time, so that it cannot be predicted with any degree of accuracy when the building will be cleared.

PARIS EXPOSITSON NOTES.

MR. E. G. BERNARD, of Troy, N. Y., has passed a few days at the Exposition looking over the electrical developments in dynamos and motors, of which he is a large manufacturer. On his way home he will stop in London to meet the electrical engineers, who assemble there before going to Paris for the Electrical Congress, etc.

LORD AND LADY KELVIN were recently visitors at the Westinghouse transformer station on the Quai d'Orsay. Lord Kelvin was much interested in the machinery and in the operation of the plant, which was explained to him by Mr. J. T. Wolfe, engineer in charge. Afterwards the distinguished visitors were taken to the central station at Moulineaux, in an electric automobile, being escorted by Messrs. L. A. Phillips and W. A. Brown, engineers of the Westinghouse Company.

MR. H. G. FIELD, of the firm of Field & Hinchman, consulting engineers of Detroit, Mich., was a visitor at the ELECTRICAL WORLD AND ENGINEER headquarters. Mr. Field is particularly interested in viewing the lighting effects on the Exposition buildings, as he was occupied in the design of the cornice lighting for the palaces of the Chicago World's Fair. He expressed warm approval of the lighting of the Château d'Eau façade, but considered that some of the other lighting would not compare favorably with the results obtained at Chicago.

A NIGHT FÊTE was held on Aug. 10 in honor of the Shah of Persia, as a departing guest. On this occasion the buildings along the Street of the Nations and the Horticultural Palaces were all brilliantly illuminated, and the thousands of electric lights reflected in the waters of the river, on whose banks the palaces stand, made an exceedingly picturesque spectacle, which attracted large crowds of people. The celebration was called a "Venetian fête," and a special feature of the show was a parade of illuminated boats covered with decorations and ornamented with Chinese lanterns.

Commercial Analysis of Small and Unprofitable Electric Lighting and Power Enterprises.

BY WILLIAM D. MARKS.

THE great number of consolidations of electric lighting and electric trolley railway companies that are to-day being consummated with the blind assumption that consolidation always means, if not increased income, at least decreased expenses, should lead the thoughtful technical adviser to careful analysis of each case before expressing his opinion on this subject.

Already practical experience is showing that consolidations do not always so reduce expenses as to warrant the increased capitalizations offered for investment to the public.

In many of our larger cities, no matter what is done in the way of extravagant first cost, no matter how heavy the fixed charges, no matter how bad the management or how great the operating expenses, the immense multitude of users of electric light and power and the teeming mass of travelers packed into trolley cars yield so large an income that the profits on the actual cost of electric stations or trolley roads are sure and generous.

There is no trouble in paying the interest and principal of a bonded indebtedness fully equal to the cash cost of the first investment, and, in addition to this, generous dividends upon stock of perhaps far greater value than the bonds issued. The lucky manager whose lot is cast in à large city has only to cling to a fortunate position and see that the routine work is well organized and efficiently performed. He can give most of his time to "managing" his board of directors, creating as favorable an impression upon them as his knowledge of human nature permits. Interest and dividends are certain, and under such conditions that man is indeed stupid or unfortunate in his associates who does not find himself on a halcyon sea. To this favorite of fortune a suggestion of careful analysis does not appeal—it would occupy much time, and would interest none of his smiling board of directors. But to-day there exists in the smaller towns of the United States a type of manager not to be envied.

Living on a starvation salary, and perplexed by stupid advisers as to how to make money out of a community where there is little or no money to be had for any purpose; harried by a board of directors and a body of stockholders—unable to furnish money for his most obvious and pressing needs in the way of machinery or lines, and yet grumbling because no dividends are forthcoming from a half-equipped plant—his most earnest efforts seem unavailing and his meagre salary is always in danger of further reduction.

His board meetings, if he can get his board together, are meetings for condolence or criticism, of which he is the object. The manager will always find that in times of prosperity his board of directors say to the world, "See how well we have done," and that in times of adversity they say, "Our manager does not seem able to do as well as we expected; we must refer you to him for explanation." This unhappy type of manager often spends his days in the varied occupations of bookkeeper, business solicitor, meter expert, mechanical engineer, electrician, wireman, road boss and bill collector, going from one thing to another until, when night comes, he finds himself too weary in body and mind to think or to stand.

Is this wise? Is it not better for him to take the time for a careful investigation of his field of operations and a rational and practical analysis of his business?

"To make an omelet it is necessary to break eggs," but one can break eggs and produce a very poor omelet unless one thoroughly understands and follows the best methods; and it may be that our village electric manager has not clearly grasped the important points in the financial management of his plant.

To succeed in an enterprise dealing in small amounts the greatest business ability and thrift are required, since a very little margin produces profit or loss to the company. The village manager is not like

the metropolitan manager, swept along by an irresistible current of business demanding his product. Every class of customer in a village demands a careful study of its case, and as great concessions as are consistent with ultimate profit to the company.

There are three factors which enter into the cost of the product of every manufacturing enterprise. In the case of electric stations these products are:

(1) Lamp-hours.
(2) Horse-power-hours or kilowatt-hours.
(3) Car-hours or car-miles.

The factors which make up the cost of these products are:

(1) *The Investment.*—From which we obtain:
  (*a*) The annual interest on the investment per article manufactured during the year considered.
  (*b*) The annual deterioration of the plant per article manufactured during the year considered.

(2) *The Fixed Annual Charges.*—These consist of taxes, insurance, rental, annual salaries, etc., covering all expenses which do not expand and contract with the volume of business done.

From these we obtain the fixed charges per article manufactured during the year considered. Bonded indebtedness is not considered for the present.

(3) *The Variable Operating Expenses.*—From these we obtain the cost of material and labor, which varies directly with the number of articles produced, and which gives the station cost of each article, covering only the items of material and pay-roll of mechanics at the bench, motormen, conductors, etc., who should be paid by the job-hour, trip or day.

To illustrate these points clearly the writer takes the actual case of a small trolley railway in a town of 9000 inhabitants, and which manages to pay operating expenses, but has not paid dividends. Its description is as follows:

Track, 4½ miles long. Cars, 5 closed motor, 3 open trailer cars. Daily car-hours or car-miles run:

1st car....5:50 a. m. to 11:20 p. m., 17h. 30m., 13 round trips, 117 miles.
2d car.....6:00 a. m. to 12:30 a. m., 18h. 30m., 13 round trips, 117 miles.
3d car.....8:20 a. m. to 10:30 p. m., 14h. 10m., 10 round trips, 90 miles.

Totals..... 50h. 10m. 324 miles.

Annual car-hours run, 18,311; annual car-miles run, 118,260; average speed per hour, 6.46 miles.

The total income of this road, with the exception of advertising and mail carrying, is derived from the operation of three cars, with the occasional use of trailers for picnics.

INCOME.

Passenger fares		$16,369.90
Advertisements		100.00
Mail carrying		150.00
		$16,619.90
Income per car-hour		90.8 cents.

The income of the road has increased about $1,200 in the last year.

We can now analyze the operations of this road, referring to the various factors of its cost and expenses.

INVESTMENT.

4½ miles of single track			$45,000
Station, car barn and machinery			20,000
8 cars, 5 equipped with motors			10,000
			$75,000
Interest (dividends 8 per cent expected)			6,000
Deterioration—Pole lines and copper	$9,000	10%	900
Ties	5,600	20%	1,120
Machinery	17,500	10%	1,750
Cars	10,000	20%	2,000
			$5,770

The cars on hand are all second-hand and of antiquated patterns. The deterioration per car-hour is 31.5 cents.

FIXED ANNUAL CHARGES.

Annual salaries	$2,694.00	
Water rent and taxes	150.00	
Office rent and steam heat	105.80	
General office expenses	240.00	
		$3,189.80

The fixed charge per car-hour is 17.4 cents.

THE OPERATING EXPENSES.

Pay-roll—Daily, weekly and hourly		$6,285.42
Coal ($1.90 per ton) bill	$1,832.84	
Coal hauling	267.75	
Forge coal, stove coal	27.10	
		$2,127.69
Material for road repairs (badly neglected)		59.25
Material for steam repairs		212.03
Material for car repairs		594.87
		$9,279.26

The operating expense per car-hour is 50.7 cents.

SUMMATION.

Deterioration per car-hour	31.5 cents.	
Fixed charges per car-hour	17.4 cents.	
		48.9 cents.
Operating expenses per car-hour		50.7 cents.
		99.6 cents.
Income per car-hour		90.8 cents.
Loss per car-hour		08.8 cents.

Total annual loss, 18,311 car-hours, $1,619.16.

Using accountants' methods a résumé will read as follows:

Deterioration	$5,770.00
Fixed charges	3,189.80
Operating expenses	9,279.26
Total	$18,239.06
Income	16,619.90
Deficit	$1,619.16

This is the deficiency that is facing the luckless general manager of this trolley road after a year of unceasing worry and work. True, if the item of deterioration is disregarded ($5,770), the manager can claim to have earned $4,150.84 above expenses, but this is only putting off the evil day of collapse from natural wear and tear.

But what of the stockholders? They are justly asking, after long years of waiting, that they shall have $6,000 or more divided among them. Seven thousand six hundred dollars more net income must be had to convert this road into a paying enterprise.

With the present system, both fixed charges and operating expenses will bear no more reduction. From past experience the manager can only hope for an increase of $1,200 next year, which reduces his deficiency to $400.

The present income of this road must be increased from $16,600 to $24,200 if steam is used.

We have noted that the three cars in use average but 6.46 miles per hour, including stops.

If the statement is true, "that a trolley road prospers more the more nearly it approximates to a moving sidewalk or platform," the cars might be required to make hourly round trips; switches being put in the single track so as to enable this change, which will only slightly increase the coal bill, because of increased speed. The cars will then be run as follows:

1st car.....5:45 a. m. to 11:15 p. m., 17h. 30m., 17½ trips, 157½ miles.
2d car.....6:05 a. m. to 12:35 a. m., 18h. 30m., 18½ trips, 166½ miles.
3d car.....8:25 a. m. to 10:25 p. m., 14h. 14 trips, 126 miles.

Totals ..... 50h. 450 miles.

This will require switches at a probable cost of $250 each, but will increase the income of the road very decidedly, because increased frequency of passage and greater speed has always increased travel. The miles traveled by cars will increase by 126, or about 40 per cent.

It appears safe under such conditions to assume an increase of 20 per cent in the income—say about $3,000 per annum. There will be no increase in wages, and hardly a perceptible increase in the coal bill, as the present engine averages only 36 horse-power, and running on friction load a good deal of the time, is obliged to waste much steam by excessive condensation.

The registered fares of the past 12 months are 337,955. There should be no difficulty in increasing them to 400,000 with the new time-table. From a loss of $1,600 we change to a profit of $1,400. To get the required net increase of income of $7,600 we still must save $4,600 elsewhere, and there is no further possible change in the direction of profit with steam power.

The concern is so small that the operating charges per car-hour are

nearly equaled by the deterioration and the fixed charges. We cannot increase our business because of the size of the towns connected.

Analyzing the road under the new régime we have: Annual car-hours run, 18,250; annual car-miles run, 164,250; average speed, 9 miles.

ESTIMATED INCOME.

Last year's income	$16,619.90	
Annual increase	1,200.00	
Increase due to fast schedule	3,000.00	
	$20,819.90	
Income per car-hour		$1.14
Deterioration per car-hour	$0.315	
Fixed charges per car hour	0.174	
Operating expenses per car-hour	0.507	$0.996
Profit per car-hour		$0.144

Annual profit, 18,250 hours, $2,628.

A profit of $2,000 more is still required to pay a decent 6 per cent dividend on the cost of this road. We have done all that experience suggests in estimating the possible future of this road, and yet find that with $1,200 annual increase we must wait three years to reach a proper dividend-paying basis.

WATER POWER.

In looking over the accounts of this road we find:

Total coal expense	$2,127.69
Wages, engineer	720.00
One-half deterioration machinery, $1,750	875.00
	$3,722.69

Within two and a half miles of the power house is a waterfall of 10-ft. height having a minimum of 450 horse-power during dry months. With its increased speed this railway will require an average of 1.40×36 horse-power, or, say, 50 horse-power. At periods when heavy grades are encountered, or when cars start simultaneously, 150 horse-power are momentarily demanded. The waterfall is more than is ever required, and its surplus power can be usefully employed elsewhere.

ELECTRIC LIGHT STATION.

In the same village is a small electric light station furnishing 150 arc lights at $72 per year to the town and its citizens, and having attached about 5000 incandescent lights. The cash value of this plant may be roughly estimated as follows:

150 arc lights at $200	$30,000
5000 incandescent lights at $7.50	37,500
	$67,500

With coal at something over $2 per short ton in the station, there is little or no profit in these arc lights after all expenses are paid. About five tons of coal per day is required by them. The incandescent lights are all sold flat rate, and probably bring an income of $3 each per year, yielding a profit of 50 cents each.

This company complains that it makes no money, but its patrons say that its charges are outrageous, and so conscientiously burn as many lamps as they can as long as they can.

What is now happening is of no consequence, for no station can be justly and profitably run without meters. These 5000 incandescents should average 700 lamp-hours each in the year, where meters are used, making 3,500,000 lamp-hours per year, or about 350,000 hp-hours, requiring 1225 short tons of coal; the arc lights require 1825 short tons of coal; the total is 3050 short tons of coal. The coal bill is in excess of $6,000 per year. The average is 2400 hp-hours per day with a maximum of, for arc lights, 150 horse-power; for incandescent lights, 250 horse-power; total, 400 horse-power.

THE WATER POWER.

We have found the maximum horse-power at the engines to be 450 (increased to 600 momentarily when arc lights, maximum incandescent load and trolley system are all operating at once under the most severe conditions). For this reason a steam engine should be retained for the incandescent loads. The following estimate will cover the purchase of the power and the removal of all machinery to a power house at the dam, and the installation of turbines and shafting:

Cost of water power and rights and existing dam		$25,000
Purchase of 500-hp machinery and building power house	$50,000	
Less value of electrical machinery	30,000	20,000
		$45,000
The deterioration is 10 per cent		7,500
The fixed charges on this plant will be about 4 per cent of its cost		3,000

The cost per horse-power is $166.67, or, for an average of 150 per 24 hours, $500 per horse-power.

When an average of 150 horse-power is assumed

$$\text{Cost} = \frac{\$7500}{150} + \frac{\$3000}{150} = 50 + 20 = \$70 \text{ per year per horse power.}$$

For 450 horse-power the cost is $23.33 per year for a horse-power.

Let us see what it has cost per horse-power in the case of the trolley company averaging 36 horse-power:

Deterioration, machinery	$1,750
Annual salaries	2,694
Coal	2,127
Total cost power	$6,571

Average cost of horse-power per year, $183 for operation during 18 hours out of 24.

We can now compute the returns from the consolidated water power, electric trolley and electric light companies.

INCOME.

From electric trolley company	$20,819.90	
From electric light company:		
150 arc lights at $72	10,800.00	
5000 incandescent lights at $3.50	17,500.00	$49,119.90

INVESTMENT AND DETERIORATION.

The electric trolley company	$75,000	
Deterioration		4,020,00
The electric light company	67,500	
Deterioration		3,750.00

FIXED CHARGES.

4 per cent of $142,500	$5,700.00	

OPERATING EXPENSES.

Pay-roll	$9,000.00	
Repairs and renewals	3,000.00	
Cost of water power	12,750.00	$38,220.00
Net profit		$10,899.90

Total value:

Trolley road	$75,000.00	
Electric light company	67,500.00	
Water power and house	45,000.00	$187,500.00

Making 6 per cent very nearly on the actual investment after every possible allowance has been made for deterioration, fixed charges and operation of works.

By judicious sale of extra power during daylight hours we can sell 300 horse-power at $50 per year, adding $15,000 to the company's income without interfering with the demands of the light or trolley systems.

By the consolidation of these companies and the expenditure of $20,000 we can convert two losing enterprises and an unused water power into a profitable enterprise. Perhaps the matter could be arranged as follows, on the basis of an issue of $200,000 in 4 per cent 30-year bonds:

The electric trolley company	$75,000	
The electric light company	67,500	
The water power	25,000	
Sold for cash at par	20,000	
Retained in treasury	12,500	$200,000

The amount of stock issued will be of no consequence, as it will take the residue after paying interest on the bonds.

Telephone Cables as Targets.

The People's Telephone Company in Minneapolis, Minn., is experiencing considerable trouble on account of its cables being shot with bullets. It took two days to locate the trouble in one of the cables. A bullet penetrated the lead casing and put out of order all the circuits.

Elements of Illumination—IX.

BY DR. LOUIS BELL.

LIGHTING LARGE BUILDINGS.

THIS branch of illumination differs from ordinary domestic lighting in several important particulars. In the first place, the aid received from diffusion from the walls is much less than in the case of smaller rooms, as has already been indicated. The experiments of Fontaine indicate that within moderate limits the light required is determined by the volume of the space to be illuminated, rather than by the floor space. That is, in a given room, doubling the height of the ceiling should double the light required for proper illumination.

Since, however, the only physical effect of the increased height is to diminish the mean distance of the diffusing surfaces from the radiants, and hence to diminish the significant fraction $\left(\frac{1}{1-k}\right)$ the change could, in point of fact, alter only that part of the total illumination due to diffused light. Hence only in the case of walls capable of very brilliant diffusion can the variation due to increased dimensions reach the magnitude indicated by Fontaine's empirical rule, which, however, possesses the merit of causing one to err in the right direction and to give ample illumination.

In large and high rooms there is a strong tendency to increase the height of the radiants above the plane of illumination, especially in case of using chandeliers, which is perhaps an important factor in the rule aforesaid. Obviously in increasing the distance of the radiants one decreases the direct illumination in the ratio of the inverse squares of the distances, and does not materially improve the diffusion.

Therefore the illumination falls off seriously. In a large and high hall lights arranged in the ceiling or as a frieze, while often giving admirable effects, are most uneconomical, and should be used, if at all, with a full appreciation of this fact. If for artistic or other reasons the lights must be placed high, reflector lamps, or their equivalent, are strongly to be recommended.

In large buildings, too, the quantity of light required is subject to enormous variation, according to the purposes to which the building is devoted, and whether the whole interior must for artistic reasons be illuminated. In a ballroom an effect of great brilliancy is generally aimed at, while a room of equal size used as a factory only needs strong illumination where it will facilitate the work.

Again, in very large rooms the power of the individual radiants can advantageously be increased, and some sources of light inadmissible in domestic lighting, such as arc lamps and large regenerative gas burners, or to be used only with caution, like mantle gas burners, may be used very freely.

But in large buildings, as elsewhere, the fundamental purpose in the lighting is to produce a certain intensity at the plane of illumination, which in such work should be assumed about 3 ft. above the floor. The absolute illumination required may vary greatly over a range, in fact, as great as from half a candle-foot to two candle-feet or even more, but the lighting may properly be calculated from an assumed value, just as in the case already discussed. For purposes of discussion, we will first consider a hall 100 ft. long by 30 ft. high by 50 ft. wide. The plane of illumination will then have an area of 5000 sq. ft., and the total volume is 150,000 cu. ft. And for simplicity we will assume 1 candle-foot as the minimum intensity to be permitted in any part of the space. Fig. 1 shows the plan of this assumed space. We will first take up the case of suspended radiants, which is the most usual method of treating such a problem. Obviously in a room of the shape given a single radiant is out of the question on the ground of economy, since in meeting the requirement of a given minimum of illumination the economical arrangement is that which exceeds this minimum at the fewest points possible. Two radiants give a possible solution, and are worth a trial. Clearly they must be located on the major axis of the room $A\ B$, but since a corner, as E, is the most unfavorable spot to light, the radiants must be placed well toward the ends of the room. We will assume their height as 15 ft. above the floor, and 12 ft. above the plane of illumination. Now the best position of a given radiant a is easily determined—it is such that taking the projections of E and C upon the plane of illumination as E^1 and C^1, $a\,C^1 = a\,E^1\sqrt{2}$, approximately. To fulfill this condition $A\,a = B\,b = 15'$ very nearly, and the two radiants are located. In this case $d^2 = 994$, and since $C = L\,d^2$, C should be practically 1000 candle-power. Allowing $\left(\frac{1}{1-k}\right) = 1.5$, each of the radiants should be of about 666 candle-power, a requirement which could be practically met by a nominal 2000-cp open arc if its glare were not so forbidding. Using incandescents, 42 of 16 candle-power would be required in each group, which should be increased to about 60 if ground bulbs in a chandelier were to be used, since lamps so mounted interfere with each other's effectiveness very materially. Reducing these figures to square feet per candle-power, it appears that the assumed conditions are satisfied by allowing as a maximum about 3.75 sq. ft. per candle-power, or with allowance for properly softening the light, 2.6 sq. ft. per candle-power.

Lighting such a space from two points only is usually by no means the best way, and a much better effect would be secured by using six radiants. The same reasoning which led us to place a and b near the ends of the major axis of the room indicates a similar shifting in the case of six lights. From symmetry, two should be on the minor axis $D\ O\ C$, and as regards the projections of C and O on the plane of illumination, the best position for a radiant, located in the same horizontal plane as before, is at a^1, about 6′ from O, with b^1 at a corresponding point on the other side of O. Now for the lateral pairs of lights. One of them may be approximately located with reference to E^1 and the projection of the middle point of the line to a^1, much as a^1 itself was located. This leads to a position c^1, 4.1′ from a^1 and 9′ from the wall. Forming now the equation $C = \frac{L}{n\left(\frac{1}{d_2} + \&c.\right)}\ d^2 = 306$, $d_1^2 = 1906$, and the sum of the other terms is little greater than the term in d_1^2. Simplifying thus, the candle-power of each radiant comes out very nearly 235, without allowance for diffusion on the one hand, or for ground bulbs and incidental losses on the other.

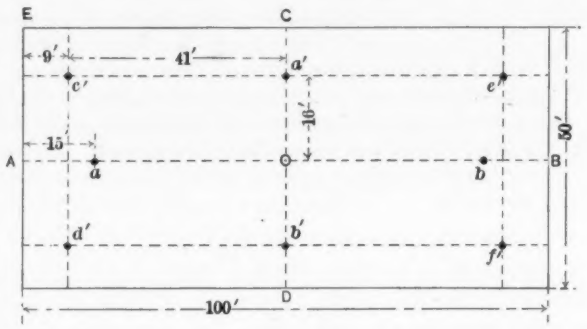


FIG. 1.

Setting these off against each other, it appears that the conditions call for 15 16-cp lamps in each of the six groups, a total of 90 as against 120 in the previous arrangement. The total rated candle-power is then 1440, or 1 candle-power for every 3.5 sq. ft.

It is interesting to check this computation based entirely on an assumed minimum illumination of 1 candle-foot with the result of experiment. For large rooms, ranging from about 1000 to 5000 sq. ft. in area, Uppenborn's careful investigations show that for good illumination 3 to 3.5 sq. ft. per candle-power is the amount required in practice. In most cases these large spaces are finished in light color, so that in spite of the high ceilings they are scarcely more difficult to light than ordinary dwellings. The absolute brilliancy required is determined by the purpose of the illumination, and the proper arrangement of the lights depends largely on architectural considerations. Oftentimes frieze and ceiling lights are used in halls, and their application to the case in hand is worth considering.

If arranged as a frieze, the lamps would be equally spaced around the walls, at about 5 ft. below the ceiling, bringing them 22 ft. above the plane of illumination. For simplicity we will assume the use of 90 16-cp reflector lamps, of the character assumed in a previous paper. Each gives approximately 27 candle-power in its hemisphere of illumination. These lamps would be spaced a little more than 3 ft. apart, giving 30 on each side of the hall and 15 on each end. Now, taking for examination the corner E^1, which is as unfavorable a locality as any, and roughly running up the illumination at this point, it falls a little short of 1 candle-foot, but a diffusion factor of 1.25 would carry it just about to the required amount. With lightly ground bulbs, which are far preferable to the clear ones in such a case, an increase to 36 lamps on each side and 18 on each end would be desirable, and 40 and 20 on sides and ends respectively would do still better.

With the original 90 lamps the total rated hemispherical candle-

power would be 2430, which is at the rate of 2.06 sq. ft. per candle-power.

Lighting from the ceiling would lead to a slightly worse result, and it is safe to say that an increase of 30 to 50 per cent in the total candle-power of the radiants is required in changing to frieze or ceiling lighting from pendant or side lights. Lights so arranged, however, can give a very valuable groundwork of illumination when reinforced by lights more favorably placed. They have the advantage of being unobtrusive and producing a generally brilliant effect, but give, if used to the exclusion of everything else, an illumination painfully lacking in *chiar-oscuro,* and light directed almost entirely downwards is, moreover, somewhat trying and unnatural, like a stage in the absence of footlights.

As has been already explained, the illumination at any particular point should have a predominant direction, else the effect on the eyes is apt to be serious. A room lighted by brilliantly phosphorescent wall paper, for example, would produce a most unpleasant effect unless the luminosity were confined to one side, or, in general, to a limited portion of wall. Something of the same objection appertains to ceiling or frieze lighting when pushed to an extreme. In the room under discussion, the best general effect would probably be produced by combining pendant or bracketed lights with about an equal amount of illumination from frieze or ceiling lights. If the room were to be used for purposes like manufacturing, lighting from rather powerful incandescents, in part with reflectors, placed at a convenient height above the machines would be the most efficient procedure. Where merely rough work is being done, arcs may be effectively used, always, however, shaded by ground or similar globes. These are distinctly cheaper, because more efficient than incandescents, but their light lacks the steadiness desirable for work requiring close attention. Six 350-watt arcs would give, in the room shown in Fig. 1, very good illumination when placed in approximately the positions deduced for the six chandeliers, with a total expenditure of 2100 watts as against about 4500 watts required by the clustered incandescents, and, say, 3600 watts required by about 36 pendant 32-cp lamps. In many cases less light than this would be required, and the total amount of energy could be correspondingly reduced, but about the above ratios would hold good.

From Fig. 1 it appears that in using arcs, about 2000 to 2500 sq. ft. may be assigned to each 500-watt arc and 1000 to 1500 sq. ft. to each 300-watt arc. It should be remembered that the enclosed arcs with inner globes are somewhat less efficient than this, and alternating arcs are somewhat less efficient than continuous-current arcs.

Arcs do their best work when placed fairly high and used in cases where protracted close attention on the part of the workmen is not necessary. They are preferable to incandescents, too, when colored objects are to be illuminated.

In workshops where special objects are to be illuminated, arcs are at a disadvantage with respect to the distribution of light, since their relatively small number forbids placing them in the most advantageous positions with respect to all the machines. They have, in short, the disadvantage of being radiants too powerful for the best distribution. It is thus found that in practical illumination arcs are considerably less efficient than their actual candle-power would indicate. The effect of the bright radiant upon the eyes, the rather dense shadows and the slanting light at a distance from the arc, unite to produce results that cannot be predicated from photometric measurements alone. For example, a 350-watt open arc is, in point of mean spherical candle-power alone, closely equivalent to ten 32-cp incandescent lamps; but in an actual installation there are few cases in which the arc could not be replaced by six such incandescents without detriment to the illumination. These interesting questions will be the object of some future attention, but the obvious continuation of the present problem is the adaptation of gas lighting to the case in hand.

If mere illumination is the object to be attained, there is little doubt that mantle burners should invariably be used in rooms of the size considered. As intimated in the last article, each such burner of the ordinary size is equivalent to about two 16-cp distributed incandescents. If the lamps are grouped in each case, the mantle burner must be given a rather better rating, being equivalent to between 2.5 and 3 such incandescents. Properly shaded the mantle burner is a very economical and effective illuminant. Were it not for the objectionable color of the unshaded light, it would be much more extensively used that it is at present. For lighting large areas, like the one we have been considering, it is very well adapted, but if the lights are placed high it is necessary not only to so shade them as to correct the color, but they must in addition be furnished with such shades or reflectors as will throw the light downward; for it must be remembered that mantle burners must be placed with the mantle in a substantially vertical position, and give the maximum intensity of light a little above rather than below the horizontal plane, while incandescent lamps, which we have been chiefly considering, throw the light in more nearly a spherical distribution, although really considerably departing from it. Reflectors are still better. Holophane globes used with the mantle burners will correct this faulty distribution and enable them to be used effectively in the case in hand.

In rooms lower than that already considered it is desirable to increase the number of radiants considerably, to avoid too oblique illumination at the more distant part of the field of each light.

With higher rooms, on the contrary, one can concentrate the radiants more advantageously and has considerable more liberty of action in placing the lights.

Fig. 2 is intended to illustrate the conditions which exist in a very high room of fairly large area. It shows in vertical section a room supposed to be 50 ft. square and 50 ft. high, the plane of illumination, *a b,* 3 ft. from the floor. We have here 2500 sq. ft. of floor surface. At the ordinary rate of 3 sq. ft. per candle, this would demand 833 candle-power, or practically 52 16-cp lamps, or with a coefficient diffusion of 1.50, about 36 such lamps.

But the previous calculations having been made for a room only one-half this height, and lamps placed considerably below the ceiling, it is clear that the greatly increased height in the present case will lead to somewhat different conditions unless the lamps are to be

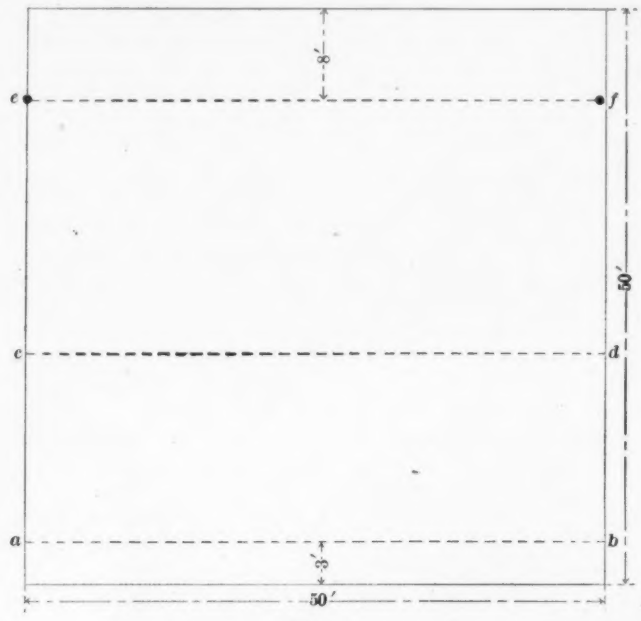


FIG. 2.

dropped very far below the ceiling—so low as to produce a decidedly unpleasant effect. Lamps placed, for example, in the plane *c d,* corresponding to frieze lamps in the previous instance, are too low to look well, while they would, on the basis just given, furnish the room with satisfactory illumination. If placed on side brackets at or below the plane *c d,* they would work well on the floor, but would present an effect of the ceiling fading into dimness unless the ceiling itself has an extremely light finish. Such a room, therefore, while very easy to light effectively, is very difficult to light both effectively and with good artistic results. Rooms of such dimensions are seldom used for manufacturing purposes, these shapes occurring more frequently in rooms for public uses of various kinds.

Without going into detailed computation which the reader can readily make for himself in the light of previous work on Fig. 1, it is safe to say that by far the best general effects would be produced by placing perhaps one-third total candle-power in 8-cp reflector lamps as a frieze, 8 or 10 ft. below the ceiling in the line *e f,* or thereabouts, and putting the remainder on brackets in groups of 3 to 6, a little below the plane *c d.* Such an arrangement obviously loses somewhat in the efficient disposition of light, on account of the great height of the lamps in the frieze, which can be depended on only for rather faint groundwork of illumination, on the plane of illumination *a b.* If, for example, the total installation consists of 600 candle-power, of which 200 is in the frieze, the mean distance of the frieze lamps from a point, say in the middle of the floor, whould be in the

vicinity of 45 ft. Consequently, allowing for the effect of the reflectors of the frieze lamps, and for what each can do by diffusion, it is safe to say that the frieze lamps would give an illumination of not over one-fifth candle-foot on the plane of illumination. Consequently, something like eight-tenths candle-foot would have to be furnished by the lights upon brackets. The amount of light furnished by these would therefore have to be about eight-tenths of the total illumination, as determined by lights placed in the relative position shown by Fig. 1, that is, the ceiling lights, one-third the total candle-power, really furnishing not over one-fifth of the total light, which means that for lights placed as just indicated, the total candle-power installed should be increased somewhere from 25 to 33 per cent, or rather more, as the bracket lights cannot be conveniently placed in favorable situations.

Hence in a room so illuminated it would not be safe to allow more than 2 to 2½ sq. ft. of floor space per candle-power, and generally nearer the former figure than the latter. To attempt the lighting of such a room by frieze or ceiling lights, as ordinarily placed, would be enormously wasteful. We shall see, however, that there are effective methods of getting a strong groundwork illumination from above without resorting to either of these methods.

Electrical Possibilities in the Far East—II.

CHINA.

By PHILIP JAISOHN, M.D.

THE nations of the world are now turning their eyes towards Tai Tsing or Great China, which is fast becoming the arena of the world's commercial and political struggles. Comprising, as it does, one-twelfth of the land area and one-fourth the population of the globe, it is not surprising that events which indicate a marked change in its political, social, commercial and industrial conditions should attract the world's attention. With an area of four million square miles of fertile soil, it is capable of producing almost all kinds of articles which support and comfort its inhabitants. Many of its hills and mountains are adorned with valuable forests and embosomed with inexhaustible treasures of precious minerals. Its rivers, which are deep and numerous, produce an abundant supply of useful submarine and aquatic products. The climate of some parts of the empire is not so desirable as others, but on the whole it is salubrious and quite agreeable to foreigners. In short, it possesses almost every advantage that nature can bestow upon a country. The United States of America is the only other country which is to be compared to the Chinese Empire in its natural resources and advantages.

It will, perhaps, contribute to a better comprehension of the immensity of the Chinese Empire to compare it with the United States, which extends about 3000 miles from Monterey on the Pacific in a northeasterly direction to Maine, and about 1700 from the Lake of the Woods to Florida. The area of this territory is now estimated at 2,936,166 square miles with a coast line of 5120 miles. China is just about one-third larger in area and possibly five times greater in population than these United States.

There is no electrical enterprise in China which deserves a lengthy description. The telegraph system is owned and operated by the Government. It has about 4000 miles of lines connecting different provincial capitals and seaports with Pekin, the seat of the Government. They have connections with the ocean cables on the south and with the Trans-Siberian line on the north, hence the important points of the empire are in speaking relations with all parts of the world. The Chinese telegraphic service is managed by a foreign superintendent, while the operators are natives. The service is fairly good in time of peace, and messages can be sent either in Chinese characters or Roman letters.

The city of Shanghai occupies the same position in China as New York does in the United States. It is situated on the west bank of the Whangpoo River and about 12 miles from the River Yangtze. The large share of the foreign trade of China which Shanghai controls is principally due to its position at the mouth of the great artery through which trade flows to and from China—the Yangtze River; transportation in bulk in China up to the present time being made almost exclusively by water, and the Yangtze being navigable by steamers and junks for more than 2000 miles, thus reaching the most populous, productive and wealthy sections of the country. Naturally a very large share of the foreign commerce entering or leaving the country passes through Shanghai, where foreign merchants, bankers, trade representatives, trade facilities and excellent docking and steamship conveniences exist. This is one of the two cities in China which enjoys electric lights, and before long it will have an electric tramway and an up-to-date telephone system. The present telephone company in Shanghai operates about 340 telephones, charging an annual rental of from 60 to 70 taels ($39 to $45.50). The instruments are of the oldest style, and the service is not very desirable. Recently the City Council decided to grant a franchise for a new telephone company to operate in Shanghai, and invited bids. The Council proposes to give the new company a thirty-years' exclusive right, reserving an option to purchase after fifteen years. It requires a deposit of 10,000 taels (about $6,500) with the bid as an evidence of good faith. If good telephones are furnished at a reasonable rental, a great many more will be used, for the Chinese of the open ports are very partial to electrical appliances.

The Municipal Council of Shanghai has also invited bids for the building of an electric tramway in and about the city, which will extend about 23 miles. It proposes to give a franchise for thirty, forty or fifty years, but the tender accepted by the Council must afterwards be ratified by the taxpayers. The specifications fix a maximum first-class fare of 10 Mexican cents and a maximum second-class fare of 5 Mexican cents for transporting passengers from one point to another on the lines. A deposit of $50,000 is required with the bid as an evidence of good faith. About 23 miles of track are to be laid at once. An overhead trolley system, supported by iron poles, is asked for.

The Municipal Government owns and operates the Shanghai electric light plant. It was erected in 1882, and there are now 122 arc lamps illuminating the thoroughfares of the settlement, besides numerous incandescent lights used in private and business houses. The city is also provided with telegraphic fire-alarms throughout the municipal limit. All of these ventures are said to be producing handsome revenues, and the outlook is most encouraging. Shanghai is destined to be one of the leading commercial centres of the world, and will be a most rich field for electrical enterprises.

The Great Northern Telegraph Company's cable was laid to Shanghai in 1871, and that of the Eastern Extension Company in 1884. There are now three distinct lines of communication with Europe. An overland line to Tientsin was opened in December, 1881, subsequently extended to Pekin, and in 1894 connected with the Russian land lines through Siberia to Europe. There is also a line west to Hankow and south as far as Tungchow on the Kwangsi border, there connecting with the French Tonkin lines. In 1896 the Chinese Government authorized the provincial officials to construct a line of railway from Shanghai to Soochow, a distance of about 80 miles. This is now in course of construction, and a portion of it has been opened to traffic. The line is to be extended to Chinkiang and Nankin. Many manufactories, under both native and foreign auspices, have sprung up of late years, and will continually increase in number as long as no obstruction is placed before the path of progress by the native officials.

Tientsin is another important city in North China which has of late made itself known to almost every newspaper reader of the world. On account of its proximity to Pekin, the political centre of the empire, and its situation at the junction of the Yunho Canal and the Peiho River, it is regarded as a most important city both politically and commercially. The city is lighted by gas and possesses water works, but there is no electrical appliance of any kind except telegraphic conveniences. However, the field is one of the most promising in China, where the possibilities of electrical development are great, and the nearness of the coal mines will be a great advantage to such an industry. Pekin, or the northern capital, is the seat of the Government; hence it is politically important, but so far as commerce is concerned there is no direct foreign trade. The whole of the capital is walled, the average height of which is about 50 ft. and 40 ft. in width. The total circumference of the walls around the two cities exceeds 20 miles. There is no industry of any note and no modern improvement of any sort. Some years ago a German firm tried to build a trolley from Pekin to Machiapoo, but the scheme failed on account of the opposition on the part of some of the mandarins.

Canton, owing to its favored situation on Chukiang or Pearl River, became at an early date an open port for foreign traffic. This is one of the largest cities of the world, as its population is estimated at 2,500,000. This gigantic metropolis of the south, like all other Chinese cities, is patiently waiting for the day when electricity will furnish its inhabitants light, power and traction. Hong Kong, near by, is, strictly speaking, not a Chinese city, yet its industries and improvements may be briefly mentioned in this connection. Under British rule the

scantily-peopled fishing village of Hong Kong has been transformed into a fine city with modern improvements. Its harbor is always crowded with ships of all nations, and its streets are lined with many imposing buildings. Some of its chief industries are sugar refineries, rum distilleries, rope, glass, match, soap, cement and ice factories, saw mills, paper mills, feather cleaning and packing establishments, two or three large engineering works, shipbuilding yards, docks and many other industries. The city is illuminated partly by gas and partly by electric light, and its telephonic and telegraphic facilities are excellent. It is only a question of time when the whole city will be traversed by electric railways. Weihaiwei, the former Chinese military stronghold on the Yellow Sea, has passed into British hands, and more than likely it will remain in her control. There is no doubt that this important fortress will be thoroughly equipped with all modern appliances under British management.

Russia and Germany have secured strategically and commercially important places on the same coast, all of which will soon be transformed into modern cities with up-to-date public improvements. The Russian Government has already appropriated $10,000,000 to improve Port Arthur and to build a new city at Talienwan or Dalny. The latter is intended to be the eastern terminus of the Trans-Siberian Railway, and will be one of the great commercial centres of the East before many years. There will be almost numberless opportunities for American electricians and engineers to exploit their professional skill and invest profitably their capital in China proper, but there are also many immediate opportunities for the manufacturers of electrical machinery to supply these foreign cities in China with their manufactures. All of these cities will have electric lights, tramways and telephones, besides many other electrical machines that are used in various industries.

Changchow, the capital of Hunan, the richest coal province of China, has an electric light plant. This is the only electric light plant which was purchased by Chinese capital and is operated by the natives. It is strictly a Chinese enterprise, and is well patronized by the leading merchants and the Government officials. The business houses and the residences of the provincial and local officials in that city are now equipped with incandescent lamps, and several arc lights illuminate the grounds of the viceroy's palace. In spite of the persistent efforts on the part of the Pekin government to discourage and check its people from adopting new ideas and inaugurating new institutions, the people of some parts of the empire are willing to open their arms to receive Western civilization. The electric light company at Changchow, the cotton mills at Shanghai, and a few other enterprises, are the crowning evidence of their willingness to introduce new life into their effete society.

The present disturbance in China and its concomitant horrors are shocking and greatly deplored, but the writer believes that the result will prove to be a blessing to all the nations which sacrificed the lives of their brave men for the sake of peace and order in China. The affair has developed into a matter of international interest, compelling the leading powers of the world to solve the problem of the future of China. For self-protection and for the good of mankind the powers will agree on one point, whether they will dismember the empire or leave it intact, and that will be to open China to the world's commerce and to develop its industries to the fullest extent with an ample provision for the protection of foreigners and their property. In other words, the results of this trouble will be increase of foreign trade, development of electrical, mining and agricultural industries, and a better and more progressive government in China. During the next 50 years China will undergo a great transformation, especially in her electrical industries. There are nearly a hundred cities in China which have 500,000 or more in population, and they will, in time, be lighted by electricity, communicated with by both telephones and telegraphs and traversed by electric railways. This may not all come during this year or the next, but the cycle of civilization will surely reach the remotest corner of China, as it has other continents and islands.

Introducing the Telephone.

Mr. E. H. Johnson, who some years ago introduced the Edison incandescent lamp and the Edison telephone in England, says: "When I offered the telepone to London I was scoffed at. I remember going to the head of a London company and explaining the value of the telephone. What do you suppose he said? 'We have been doing business here for four hundred years and we never had a telephone. I think I can get along without them.'"

A New Incandescent Street Lamp Fixture.

By A. B. Proal.

(CHIEF ENGINEER NEW YORK AND STATEN ISLAND ELECTRIC COMPANY.)

Of late there has been little written on series incandescent lighting. The reasons for this are as follows: first, the amount of current used is extravagant for results obtained, and second, the uncertainty and the irregularity of the service. Incandescent street lighting has, however, a great many advantages over arc lighting in certain districts. This is especially true in districts that are heavily shaded. The disagreeable shadows cast and the intensely bright spots shown on the roads from an arc light are almost entirely obviated by the incandescent service. Until recently there have been but few successful methods of operating series incandescent lights. Among the most notable is the Heisler. This system is a constant current system. The principal objection to it is that the circuit has to be led back to the station, where it is controlled by an automatic regulator. The cost of sockets and their cut-outs, and of lamps used in this system, makes it a very expensive one so far as repairs are concerned. The second system is one which is largely in use, where lighting is distributed over large territories. It is the ordinary shunt system. All the incandescent lamps are strung in series, and across the two terminals of each lamp, a shunt box is placed. If one of these lamps burns out, the voltage is maintained practically constant on the remainder of the line, the excess of energy thus thrown on the line being absorbed by the shunt. This system has a number of disadvantages as well as advantages. The principle disadvantage is the excessive amount of current consumed. In large circuits this amounts to a great deal, as the shunts absorb in the neighborhood of 16 per cent of the total energy generated. Another drawback in this system is that in case of a short-circuit on the line, a large number of shunts are almost invariably burned out. Often more than one-half of the shunts in the series are lost in one storm.

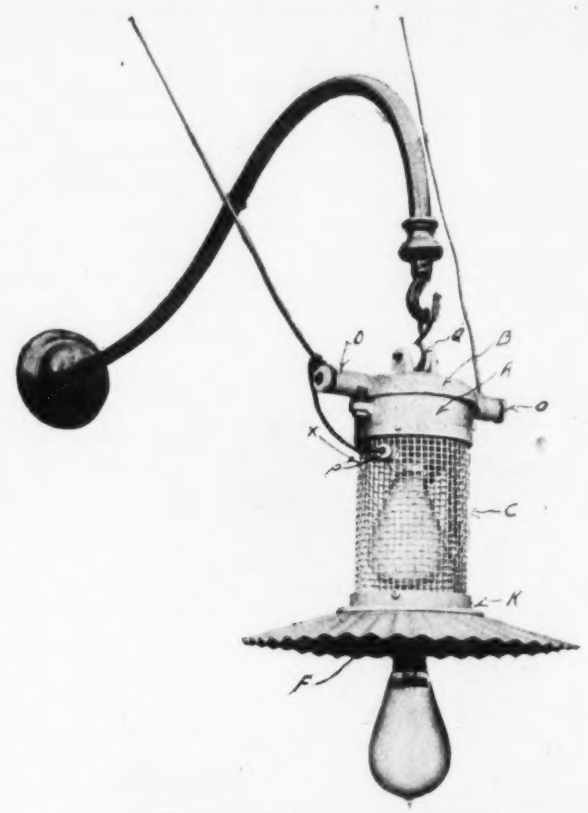


FIG. I.—NEW INCANDESCENT LAMP FIXTURE.

The third system in general use is the ordinary parallel system of wiring. Sometimes these circuits run on a 3-wire system, and sometimes on an ordinary 2-wire system. This system can be fed from main lines at any point by an ordinary transformer, but where large territories are covered it is a very expensive system to install, as it is always necessary to run at least two wires and to place a large transformer at the beginning of the series. Often the wires have to be large enough to overcome the excessive drop.

The fourth system is a new, constant current method, where the

current is maintained constant by a constant current transformer or a reactive coil. It has the same disadvantages that we find in the Heisler system, i. e., we have to use a special high-priced lamp, and a special socket and cut-out.

The fifth system is one not known to the general public, and is employed by a large company which operates in the neighborhood of

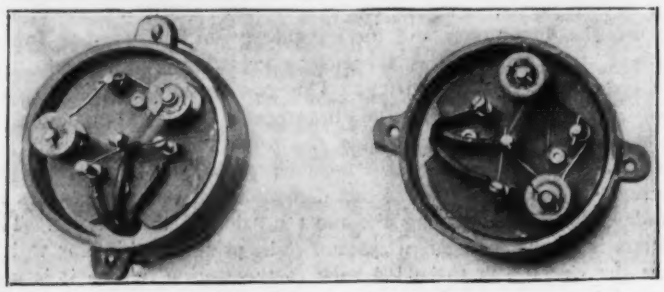


FIG. 2.—THE CUTOUTS.

5000 series incandescent lights over a district of 17 miles in one direction and 9 miles in another. This company found that the ordinary series systems were entirely unsatisfactory and very expensive to maintain, and set about devising some means to rectify this trouble. They finally adopted a scheme which is termed the "C-W" system, named after its patentees, who are the line superintendent and lamp man of the company. It is simple in the extreme and has been in operation for nearly a year, and is giving perfect satisfaction. During the entire period that they have had these lamps up they have not lost one.

It will be noted that the lamp as it hangs on the pole is a radical departure in appearance from any other incandescent street lamp. It is composed primarily of a shunting device which is placed in a casting that forms a cup on top of the lamp, shown at *A*, Fig. 1. The shunt *A* is surmounted by a cover *B* which makes an airtight and

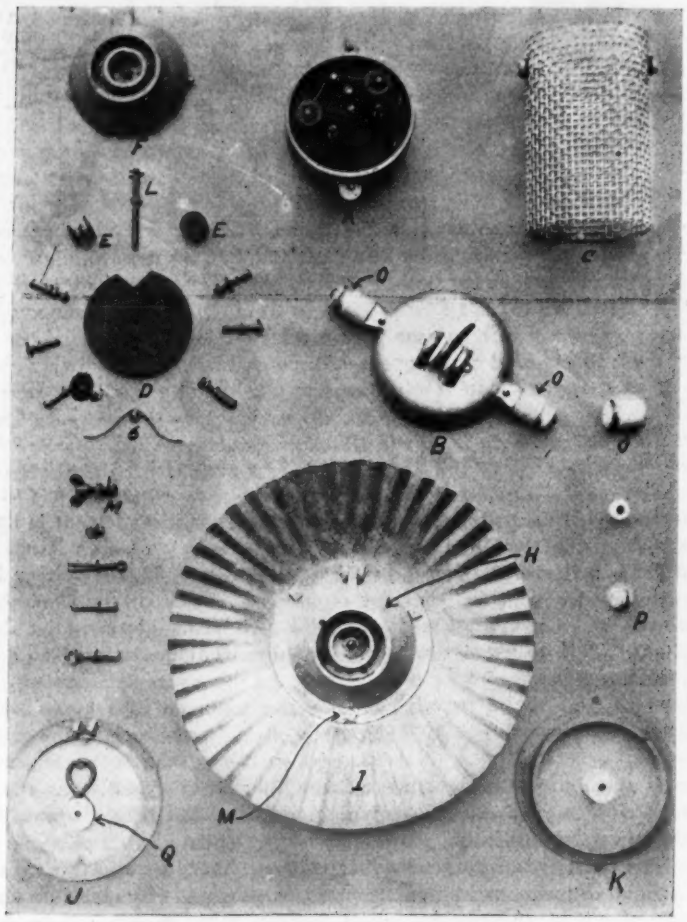


FIG. 4.—PARTS OF FIXTURE.

water-proof box, in which the shunting mechanism is placed. Directly beneath the top of the lamp, a wire screen is fastened, from which hang a shade and the receptacle for holding the main lamp. On the underside of the cup *A* an ordinary porcelain wall socket is fastened. In the cone-shaped casting *F* a similar socket is fastened. This cone-shaped piece is hinged to a collar shown in *J*, Fig. 4, and a shade is placed between this collar and a similar one, *K*, shown in Figs. 1, 3 and 4. This collar *K* serves the double purpose of fastening the shade and the lamp holder to the wire screen, and stiffening the shade. The bottom cone *F* is fastened to the shade by the hinge and

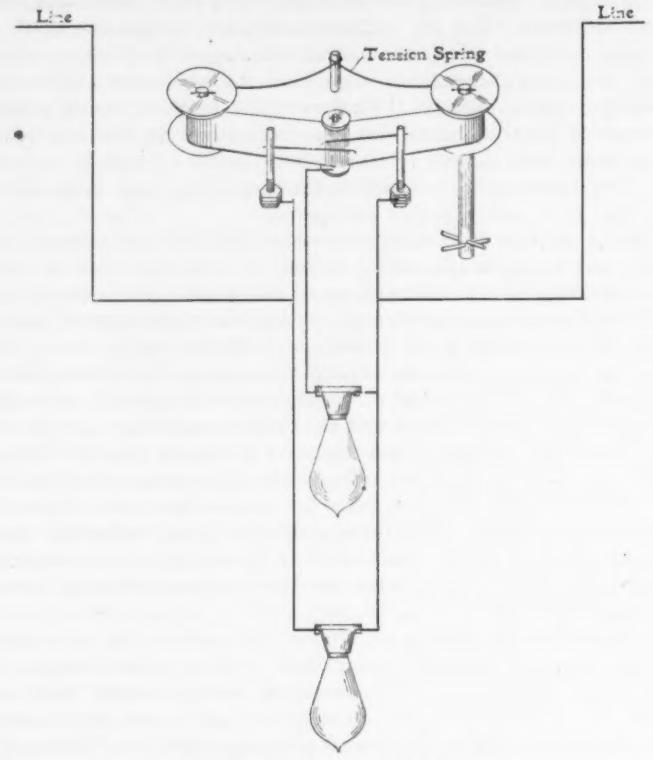


FIG. 3.—DIAGRAM OF WIRING.

the thumb screw *M*. Insulators *O*, *P*, and *Q* thorougly protect the lamps from coming in contact in any manner with the ground. The shunting mechanism consists of a hard fibre block *D*, from which are supported contacts and two bobbins carrying a strip of paper.

A glance at Fig. 3, which is a diagram of the wiring of the circuit, will readily show the use and construction of the shunting mechanism. It will be seen that there are always two lamps in a completed

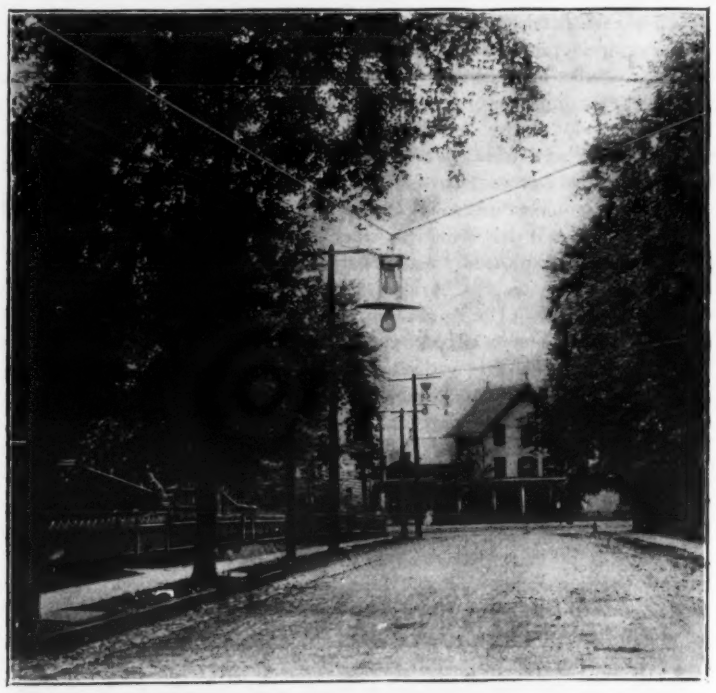


FIG. 5.—LAMP SUSPENDED OVER STREET.

fixture. One lamp is encased in a wire screen and is readily accessible by simply turning the thumb screw, letting the bottom cone *F* swing down. The object of having these two lamps in the fixture is to assure the certainty of light. If the lower lamp *A* is burned or

broken out, the current instantly jumps through the paper at the spring contacts in the shunt and lights the lamp which is enclosed in the wire screen. If the second lamp should burn out, the other contact somes into play, and the circuit is closed, through the contact stud, and continues to operate with one lamp short in the series. When the inspector again makes his rounds, he simply gives the brass rod *L* a slight turn, which rolls up the slip of paper on one of the bobbins, replaces the broken lamp, and everything is in readiness again for the night. The rod *L* is shown through the cut in the wire screen at *X*, Fig. 1.

Great care has been exercised in the construction of this device to eliminate the leakage of the current across the porcelain insulators used. By experience the lighting company has found that one of the most serious troubles in high tension work is caused by the iron coming in contact with the porcelain. In a short time the iron rusts and deposits the oxide on the insulators, which eventually leads to a large leakage, and sooner or later burn-outs occur from this. In the construction of this lamp copper and brass have been used in these places. It has been found necessary to encase the one lamp in a wire screen, as by far the greater number of renewals are caused by boys breaking the lamps with stones. The point which appeals most forcibly to the station manager in the use of this new shunting device is the great current economy, and the operating economy derived from having no shunts burned out.

The Nernst Lamp at the Paris Exposition.

The Nernst electrolytic lamp, one of the latest electrical inventions of importance, forms, from the standpoint of electrical men, one of the most interesting exhibits at the Paris Exposition; for, although considerable has been written about it in the technical press, comparatively few have, as yet, had an opportunity to see it in practical operation.

The Nernst patents in Germany have been acquired by the Allgemeine Elektrizitats Gesellschaft, of Berlin, and it is this firm which makes the exhibition at Paris. The pavilion of the A. E. G. in the German court of honor in Electricity Building—already illustrated in the ELECTRICAL WORLD AND ENGINEER—has its interior entirely illuminated by Nernst lamps, some 300 lamps being distributed over the walls and the domed ceiling of the structure. The pavilion is open to the public, and the lamps are shown in operation every afternoon from 3 to 6 o'clock. The lamps in the main space of the pavilion are of the ordinary Nernst type, i. e., they require to be heated up by a flame to start them, but in the entrance halls are shown a number of lamps with an automatic ignition attachment. The ordinary lamps are ignited by an alcohol torch. The illumination of the interior of the pavilion when all the lamps are in operation is somewhat excessive, and for this reason only a fraction of the total number of lamps is usually in operation. The provision of the large number of lamps permits, however, of showing the various degrees of illumination that may be obtained with the new lamp.

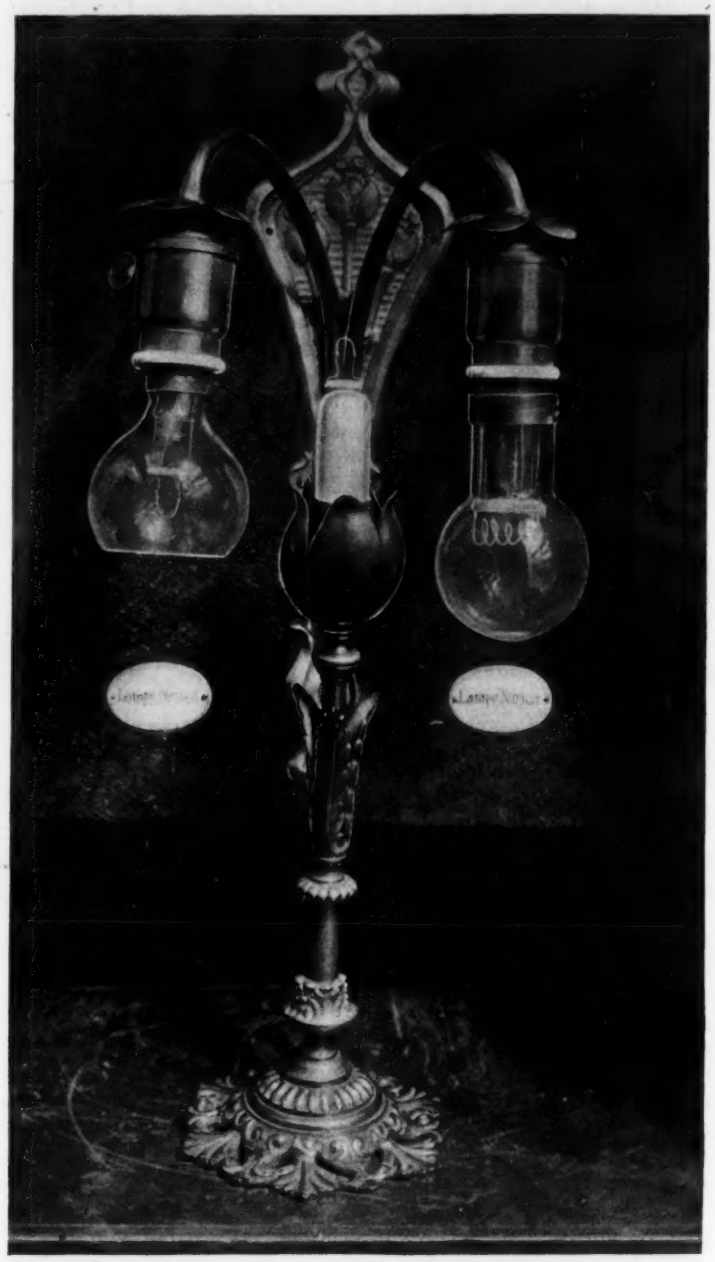
The chief characteristic of the Nernst lamp, as our readers are already aware, is the employment of a filament made from an oxide of the rare earths, which is a non-conductor of electricity at the ordinary temperature, as, for instance, magnesia.

It is well known that the efficiency of a source of light depends greatly upon the temperature to which the particles of the flame or incandescent body are raised. Upon this theory may be explained the great superiority as regards efficiency of the arc light when compared with the electric incandescent light. The light emitting substance is the same in the two cases, viz., carbon; but while in the one case the temperature of the carbon is that of volatilization, in the other case it has to be limited so as not to affect the structure of the filament in a deleterious manner.

The limit of temperature at which the carbon filament of incandescent lamps can be operated has practically been reached, and there is, therefore, not much chance for improvement in this direction. Indeed, further advances in the art of electric illumination are mainly to be expected from the use, as incandescent bodies, of materials which are non-conductors of electricity at the ordinary temperatures. According to the law of Kirchhoff, all opaque bodies emit more calorific than luminous rays, furnishing what is termed the normal spectrum of an opaque body. But according to the well-established electromagnetic theory of light, all conductors of electricity are of necessity opaque to luminous radiations. It is to be expected. therefore, that as long as electrical conducting materials are used as light emitting substances in lamps, the bulk of the energy expended upon them will be wasted in thermal radiations and only a small portion will be transformed into luminous radiations. It is impossible to make an efficient lamp with such materials except under the conditions of working at the temperature of the electric arc.

The problem which Prof. Nernst set out to solve for electric illumination had already been solved for gas lighting, and he freely admits that the work of Auer suggested to him the experiments which led to the invention of the electrolytic lamp.

In an ordinary gas flame the heat due to the chemical combination of the carbon atoms with the oxygen of the air raises the former to a high temperature, at which they give out a certain amount of light.



NERNST LAMP EXHIBIT, PARIS.

If a mantle, such as is used in incandescent gas lamps, is placed over the flame it will reach about the same temperature as the latter and give out quite a few times the amount of light originally produced by the flame. This result is due to the fact that the oxides which form the base of the mantle have a spectrum which is much richer in luminous rays than is the spectrum of carbon. The difficulty of utilizing this principle in an electric lamp is due to the fact that the materials of which incandescent gas mantles are made are non-conductors of electricity at ordinary temperatures. It has been known that when in the fused state these materials form electric conductors of the second class, or electrolytes, but bodies in the fused state are naturally unsuitable for use in lamps. The experiments of Prof. Nernst led him to the discovery that combinations of the oxides, for

instance, of magnesia with porcelain, form a good conductor of electricity at a high temperature. There remained, however, the possibility that the electrolytic action of the current would alter the chemical composition of the filament. With alternating currrents it was found that the electrolytic action was too feeble to cause any trouble, and it has now been possible to reduce practically to zero the electrolytic effects of continuous currents.

The oxides which form the material from which the Nernst filament is made are not affected by the oxygen of the air at high temperatures, and it is therefore not necessary to enclose the filaments in a vacuum globe.

The preliminary heating of the filament can be accomplished with a match, but this method is objectionable and an alcohol torch is preferred. In cases where the preliminary heating of the filament by a flame is objectionable automatically igniting lamps are made use of. The automatic ignition is obtained by means of an electric current heating to a white heat a thin platinum wire wound on a porcelain cylinder placed very close to the filament. An electromagnet is connected in series with the filament and when the current through the filament and magnet reaches a certain strength the magnet attracts its armature, thereby interrupting the current flowing through the heating coil. The entire mechanism is placed in the socket of the lamp and is so simple that practically no trouble is experienced with it.

The price of the automatically igniting lamp is naturally much higher than that of the ordinary lamp. The increase in price is due to the electromagnet and the heating coil. The electro-magnet has the same life as the lamp, as there is no wear or deterioration. For the heating body the same length of life is guaranteed, but after it is unfit for use it has still two-thirds of its original valûe. It is expected, however, that the platinum wire will soon be replaced by a wire of less expensive material, which will serve the same purpose. It is stated that the price of the deteriorating parts—filament and heating wire—is not too much to make the cost per candle-power hour the same as with the ordinary incandescent lamp. The little prominence given to automatically igniting lamps at the exhibit would create the impression that the Allgemeine Elektrizitats Gesellschaft is of the opinion that the ordinary Nernst lamp has the greater field of usefulness.

The life of the filaments depends, as is the case with the carbon filament, upon the regulation of the pressure in the circuits to which the lamp is connected. If the fluctuations do not exceed the normal, one may figure on a life of 300 hours. The life is limited by a molecular change in the filament, which takes place little by little. This is accompanied by a diminution of the solidity and often by an increase in the electrical resistance, which decreases the brightness of the lamp.

The energy consumption in the Nernst lamp is from 1½ to 1¾ watts per candle. Lamps are at present constructed of 25, 50 and 100 candles, and for 110 and 220-volt circuits.

In regard to regulation, it may be noted that the resistance of an electrolytic filament falls rapidy as the temperature increases. On the other hand, the resistance of iron rises rapidly at the temperature at which it loses its magnetism. This property enables the current to be regulated in the Nernst lamp. In series with the filament is an iron resistance so proportioned that with normal current the wire is at a temperature within the range corresponding to the sudden rise of temperature.

All the mechanism of an ordinary lamp is in the socket, which is slightly larger than the old Edison socket. The lamp bulbs are of about the size of a small 16-cp bulb, and give a candle-power of 25. In the photograph shown herewith, the lamp with the open bulb is started by the flame of a match. A Nernst filament, it may be said again, is ordinarily renewable after 300 hours. We are indebted for data and other courtesies to Dr. Nernst, and Messrs. Oertli and Kramer, of the exhibit staff.

A new factory has been erected by the A. E. G., and the manufacture in quantities has already begun. The A. E. G. operates one of the largest incandescent lamp factories in the world. Its continuing to manufacture incandescent lamps, while claiming a much greater economy for the Nernst lamp, might lead to misunderstandings. The company, therefore, makes the announcement that it does not think that the Nernst lamp will so soon take the place of the incandescent lamp, but is of the opinion that in the course of time it will have considerable influence upon the use of incandescent lamps and on the employment of arc lamps as well.

Joint Meeting of the British and American Electrical Engineers.

The joint meeting of the British Institution of Electrical Engineers and the American Institute of Electrical Engineers took place at the Paris Exposition, on the banks of the Seine, in the American Pavilion on Aug. 16. The meeting was called to order by President Hering at 10 A. M. There were two chairmen—President Carl Hering and Prof. Perry, president of the British Institution, but by agreement the control of the meeting devolved upon Prof. Perry, after the preliminary announcements had been made.

M. Mascart was invited to address the meeting, and in a brief, graceful speech expressed his thanks to the British Institution for having conferred upon him the title of vice-president, and his welcome to the members of the American Institute on their meeting in Paris.

Mr. S. Z. de Ferranti then opened the discussion set for the occasion on "The Relative Advantages of Alternate and Continuous Currents for a General Supply of Electricity, Especially with Regard to Interference with Other Interests." He alluded to the danger which existed in the transformation from high-pressure alternating currents to continuous currents for operating electric railroads, and intimated that if alternating currents could be utilized for traction systems, the danger of damage to iron pipes by electrolysis would be largely reduced.

Mr. B. J. Arnold described American practice in regard to the long-distance electric transmission of power for traction systems. He also alluded to the fact that the alternating-current and direct-current systems had their special fields of usefulness, and that while the former was pre-eminent for high-pressure transmission, yet the direct-current three-wire system at 500 volts between outside wires had recently displaced alternating-current systems in St. Louis and Cincinnati, with advantage.

Sir W. H. Preece drew attention to the inductive disturbances which alternating-current systems effected on telephonic and railway-signalling systems, and to the means by which such disturbances might be eliminated.

Mr. A. E. Kennelly compared the relative advantages of the direct and alternating-current systems for electric traction, alluding also to the relatively greater danger of accidental shocks from alternating currents at 500 volts pressure, and to the fact that direct current railway systems seriously interfered with magnetic observatories, which latter could, however, be removed to distant places in exchange for the advantages which electric railways conferred on the community.

Prof. W. E. Ayrton pointed out that the change from a direct-current railway system to an alternating-current railway system did not necessarily remove all danger of electrolytic corrosion to buried metallic pipes in the neighborhood. He cited recent experiments showing that alternating currents were capable of producing electrolytic corrosion. In the case of magnetic observatories near London, it had been found that by taking the precaution of breaking the lines into mile sections fed and returned at the centre, the maximum difference of potential in the rails was reduced to less than one-fifth of a volt, and the magnetic disturbance at the observatories was negligibly small.

M. Korda, of Paris, described the various conditions under which a selection between alternating and direct-current distribution was often effected.

Prof. F. B. Crocker considered that in the case of disturbance to magnetic observatories the value of the injury would be much outweighed by the advantage secured in public convenience in travelling by electric power. He believed that electrolytic troubles might be reduced to within reasonably negligible limits. He showed that the efficiency of modern direct-current and multiphase alternating current motors of equal brake horse-power was practically identical.

Mr. W. M. Mordey mentioned that in a certain traction system in Great Britain 28 miles long, recently examined by him, the drop in the rails was not only within the seven-volt board of trade requirement, but was less than five volts. He believed that if electrolytic effects could be eliminated, much more than seven volts drop in the return mains could take place without disadvantage. He did not fear capacity effects in properly designed underground mains carrying alternating currents. He thought that insulated return wires on such a plan as a double-trolley system would overcome the electrolytic difficulty satisfactorily.

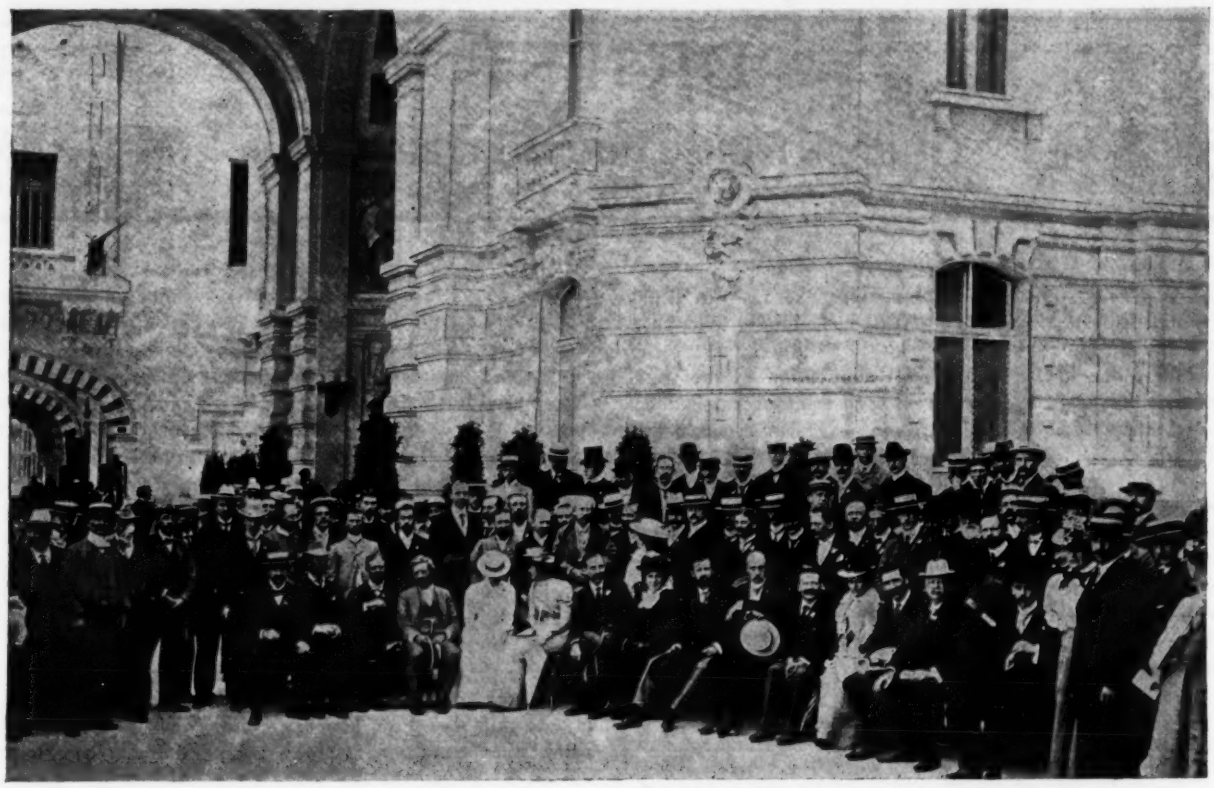
Mr. C. O. Mailloux discussed the relative advantages of the direct and alternating-current systems, particularly with reference to the low power factor of polyphase motors.

Prof. Silvanus P. Thompson spoke in favor of alternating-current transmission from generator to motor. He did not think there was any additional danger to life or person from alternating currents. He pointed out the relative inefficiency of high-voltage incandescent lamps. He believed that polyphase alternating-current transmission throughout would not only eliminate the converter, but would also improve the efficiency of distribution and give better results in every direction. He instanced the Swiss electric railways which employ polyphase motors.

Mr. H. Ward Leonard did not consider that the Swiss railroads referred to by Prof. Thompson had sufficiently powerful starting torque for proper service. He believed that the transformer would disappear in the future and that alternating currents would be supplied along the mains. The discussion then closed.

Mr. E. Hospitalier, General C. E. Webber, Mr. J. Gavey, and Mr. Carl Hering gave brief descriptions of the principal features of interest to electrical engineers in the exhibition, and arrangements were made to conduct parties through the halls to visit the most interesting exhibits.

The session closed with a vote of thanks to the American Commissioner-General, Mr. F. W. Peck, for courtesies extended in the use of the American National Pavilion, etc.



MEMBERS OF THE BRITISH AND AMERICAN INSTITUTES OF ELECTRICAL ENGINEERS OUTSIDE U. S. PAVILION, PARIS EXPOSITION.

CURRENT NEWS AND NOTES.

THE "THIRD RAIL" IN BROOKLYN.—Deputy Commissioner of Public Buildings, Lighting, and Supplies Kirwin and the elevated railroad officials of Brooklyn are working on plans for doing away with the danger to life in the "third-rail" system in use on the elevated railroads. The recent fatal accidents attributable to the third rail have impelled Commissioner Kirwin to take steps to compel the company to make the system less dangerous to life. One plan that has been proposed is to place the rail in the middle of the track instead of on one side, and protect it with upright boards projecting a few inches above it.

THE EDISON CONVENTION.—The Association of Edison Illuminating Companies will hold its sixteenth annual meeting—twenty-first convention—at the Grand Union Hotel, Saratoga Springs, Sept. 4, 5 and 6. Mr. John W. Lieb, Jr., is president, and Mr. Wilson S. Howell, secretary. An excellent programme has been provided. It is expected that the following papers will be presented: "Some Notes on Electric Elevators," Arthur Williams, New York; "Systems and Apparatus for Light and Power Distribution," C. P. Steinmetz, Schenectady, N. Y.; "Polyphase Distribution," G. Semenza, Milan; "Electric Elevators and Electric Hoists," John F. Gilchrist, Chicago; "The Electrical Features of the Paris Exposition," W. C. L. Eglin, Philadelphia, Pa.; "The Year's Improvements in Meters and Measuring," C. D. Haskins, Schenectady, N. Y.; "Residence Rates in Detroit," Alex. Dow, Detroit, Mich.; "Arc Lighting Systems," Walter Fish, Lynn, Mass.; "Distribution from Transmission Circuits," D. L. Huntington, Spokane, Wash.; "The Past, Present and Future of the Incandescent Lamp," John W. Howell, Harrison, N. J.; "Efficiency of Electric Distributing Systems," F. Torchio, New York; "Results in the Application of the Maximum Demand Rate System," C. S. Knight, Boston, Mass.; "Twenty-five Cycles vs. Sixty Cycles for Union Lighting Station." C. F. Stott, Buffalo, N. Y. On Friday, Sept. 7, by invitation of the General Electric Company, the delegates and guests will be taken by special train to Schenectady to visit the works of the General Electric Company.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.—The tenth annual meeting of the American Electro-Therapeutic Association will be held at the Academy of Medicine, 17 West Forty-third Street, New York City, Sept. 25, 26 and 27. The programme is a long one, and includes several papers on the use of electricity in the treatment of disease. Among the electrical papers are the following: "Electric Light as a Therapeutic Agent," by Chas. O. Files, M.D., Portland, Me.; "Advances in Coil Interrupters for X-Rays," by E. W. Caldwell, New York; "Use of the Continuous Current and Electrolysis," by Robt. Newman, M.D., New York; "The Choice of a Coil for Use with Currents of High Amperage," by R. J. Nunn, M.D., Savannah, Ga.; "A Universal Electro-Therapeutic Switch-Board," by Wm. J. Herdman, M.D., Ann Arbor, Mich.; "Spark Gap Currents, viz.: Franklinic Interrupted Static Induced, Wave Currents," by Wm. J. Morton, M.D., New York; "A New Form of Fluid Interrupter for Using Direct Current," by Emil Heuel, M.D., New York. The following committees will make reports: Committee on induction coils and alternators; on meters; on static machines and condensers; on constant current generators and controllers (report includes dry batteries for electro-therapeutic use); on electrodes; on electric light apparatus for diagnosis and therapy and the Roentgen X-ray. The entertainment programme includes visits to one of the exchanges of the New York Telephone Company, Automobile headquarters, and to the Metropolitan Street Railway power-house.

LETTER TO THE EDITORS.

The Doherty Plan of Charging.

To the Editors of Electrical World and Engineer:

Sirs:—I note that discussion of the Doherty plan of charging is invited by one of your correspondents. The plan has many commendable features and is evidently the result of much thought and study. There are some things, however, it does not accomplish, and its application will bring out objections chiefly among the consumers who have to be "educated."

Those who are doing a successful business do not want it; it does not provide for the lighting of churches, auditoriums, halls, etc., where there is generally a large demand with a comparatively small consumption; it does not provide for factories, offices, etc., where in winter a large demand exists for the time; it does not, apparently, take into consideration that a customer might wish to move during the year, though perhaps discontinuance of such contracts might not affect the working of the plan. There is the difficulty of fixing the demand without friction. If the consumer is allowed to fix the demand and a device is used to warn him of the limit being reached, there is the difficulty of knowing in advance whether the demand will be large enough to make the "readiness to serve" charge adequate to cover that part of the cost of production.

A canvass among the consumers might determine the point; only the stores, shops, offices, factories, etc., might object to paying the demand, based on the number of lights in service at one time, when a house with the same number of 16-cp lamps installed paid, say, only two-thirds as much, or even less.

The plan does not contemplate fixing the demand arbitrarily, but that seems to be the only sure way to figure the income. In order not to have the demand excessive for houses, lamps in cellars, closets, certain rooms, etc., could be neglected as being used because others were not portable and not for long burning, or all together, a percentage of all the others (say two-thirds) being taken as a basis. Such a plan as that would tend to make it easier to introduce in places of business, etc., if the "readiness to serve" charge were low enough to be attractive.

R. J. P.

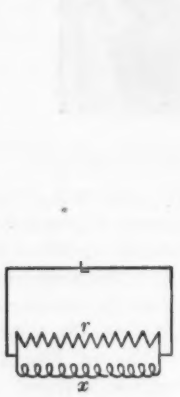
MASSACHUSETTS.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

Temporarily Conducted by E. F. ROEBER, Ph. D.

DYNAMOS, MOTORS AND TRANSFORMERS.

Starting Three-Phase Induction Motors.—GUILLAUME.—An illustrated description of a starting device of Fischer-Hinnen, used on a three-phase induction motor, exhibited by Krizik, Prague, at the Paris Exposition. The device is a special application of the well-known method of starting the motor with high-armature resistance, and cutting out this resistance with increasing speed as far as possible. The feature of Fischer-Hinnen's arrangement is that this cutting out is done automatically as follows: Each of the secondary circuits S of the motor is connected with a resistance r and a reactance x, connected in parallel, as shown in Fig. 1; in practice the reactance x is an induction coil of a high coefficient of self-induction and of an ohmic resistance, which is very small, compared with the resistance r and with the resistance of the secondary circuit S. Then it will be seen that with varying speed of the motor the reactance x varies, as it is proportional to the frequency of the secondary e. m. f., and this frequency is proportional to the slip; that is, to the difference between synchronism and speed (in cycles). When the motor is started the speed is zero and increases up to a maximum, which is nearly synchronism; therefore the difference between synchronism and speed decreases at the same time from a maximum to nearly zero; hence also the reactance x decreases from a maximum to nearly zero. It is easy to find the variation of the joint impedance of the parallel connected resistance r and reactance x (by calculating conductance and susceptance of the two branches and adding them, etc.). The resistance r and the reactance x in parallel act together like a joint impedance (a resistance and a reactance in series), the joint resistance being $rx^2 \mid (r^2+x^2)$, the joint reactance being $r^2x \mid (r^2+x^2)$. In the moment of starting x is a maximum, hence also the joint resistance a maximum; from this maximum the joint resistance decreases while x decreases, until when the motor has run up to full speed the joint resistance is nearly zero, as x is nearly zero. Fig. 2 gives the connections for a three-phase induction motor; collector rings are used to convey the induced secondary currents to the resistances and reactances in parallel; star connection is used in this case. He finally remarks that the starting device requires a small space only and can be placed in the rotating armature, so that no collector rings are required.—*L'Eclairage Elec*, July 28; *L'Ind. Elec.*, July 25.



..FIG. 1.

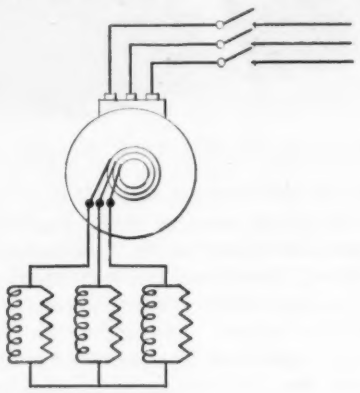


FIG. 2.

Motors.—C. W. HILL.—A brief article, illustrated by diagrams. In designing motors for some classes of work, it is necessary to take into account not only the average hp which the motor is to develop, but also the maximum torque which it is to exert. Where no limit of current is specified, the average hp only need be considered; but in cases where a machine is specified to give a maximum torque with a current not exceeding a given figure, then the specified torque and current must be taken as the basis of the design. There is a certain speed for which a motor must be designed, in order to fulfill fixed conditions as to voltage, current and torque; and on a circuit of given voltage the smaller the current specified for the production of a given torque the slower must be the speed, and therefore the larger the size of the motor. Where a steady speed is demanded from constant voltage mains and hand regulation is not possible, shunt winding gives the most satisfactory results, but where the leads are long and the fall of voltage appreciable, compound winding should be adopted.—*Lond. Elec. Rev.*, Aug. 3; reprinted in *El'ty*, Aug. 22.

REFERENCES.

Induction Motors.—HEYLAND.—A long paper, illustrated by many diagrams. In the first part he gives an outline of the theory of the induction motor, develops his well-known diagram, and shows how to apply the theoretical results in the simplest way for practical tests of induction motors; in the second part he illustrates his theoretical explanations by several special numerical examples. The paper gives a clear and concise summary of the theory of the induction motor in the form developed by Heyland, Rothert and others.—*L'Eclairage Elec.*, July 7-14.

Inductor Alternator.—GUILBERT.—A mathematical paper, illustrated by diagrams. He develops four formulas for the ratio between the magnetic stray field and the total magnetic flux of an inductor alternator. His formulas agree better with values found by tests than an old formula of Kapp, which gives often too small values of the ratio.—*L'Ind. Elec.*, June 25.

Two-Pole and Multipolar Dynamos.—A communication giving comparative figures as to the weights and efficiencies of two direct-current 200-kw dynamos, running at a speed of 50 revolutions per minute, the first machine to be a two-pole one and the second a

multipolar. The comparison has been worked out on a basis of equal heating.—*Lond. Elec. Eng.*, Aug. 10.

LIGHTS AND LIGHTING.

Conductivity of Oxides at High Temperatures.—SOHLMAN.—An account of a systematical investigation of the conductivity at high temperatures of such oxides which may be utilized for lighting purposes. The conductivity of the various oxides, and the temperature at which they become conductors, vary greatly, but there is a close relation between these properties and the place of the elements in the periodic system. *Elek. Zeit.*, Aug. 9.

REFERENCES.

Incandescent Lamps.—WILLCOX.—The conclusion of his long, well-illustrated Franklin Institute paper, abstracted in the ELEC. WORLD AND ENG. Jan. 6, and noticed in the Digest April 14 and May 26. The remarks of Rowland and Stine in the discussion which followed are also reprinted, with a reply of Willcox.—*Jour. Frank. Inst.*, June.

POWER.

Prime Movers for Driving Alternators Connected in Parallel.—CHEVRIER.—A note on the part which the speed regulators play in the parallel working of alternators. Any machine which has to drive an alternator that has to work in parallel with other alternators, must be provided with two different devices of mechanical regulation, the one acted upon automatically by the speed variations, the other to be regulated by hand, allowing to modify the driving power for a fixed speed.—*L'Eclairage Elec.*, June 16.

Power Transmission in Sweden.—A brief article on a power plant erected at the Trangfors waterfall, at Voestmanland, Sweden. There are six 300-hp turbines driving the alternators; the exciters are driven by small turbines. The current is transmitted at 14,000 volts over a distance of some 14 miles to the town of Vesteras, where it is used especially for power purposes; the motors are throughout induction motors.—*Eng'ing; Elec. Rev.*, Aug. 15.

Direct Current Power Transmission.—PERKINS.—A brief illustrated article on direct current power transmission from a waterfall of the Areuse River, Switzerland, to adjacent towns for lighting and power purposes. The line is 21 miles long. The power house contains three 250-hp dynamos, generating direct current at 2,600 volts; the machines are operated in series.—*El'ty*, Aug. 15.

REFERENCES.

Regulation in Long Distance Transmission.—PERRINE.—A reprint of his paper abstracted in the *Digest* Aug. 25.—*El'ty*, Aug. 22; *Elec. Rev.*, Aug. 15.

Niagara Falls.—An article on activity at Niagara Falls and an illustrated description, by Dunlap, on the new wheel-pit.—*Elec. Rev.*, Aug. 15; another illustrated article by Dunlap on the new wheel-pit in *West. Elec.*, Aug. 18. (See ELEC. WORLD AND ENG., April 7, 1900).

Electric Power Transmission in India.—A note on a scheme of transmitting 4000 hp from the Canvery Falls to the Kolar gold field, over some 100 miles, for use of electric power in the mines.—*Lond. Elec. Eng.*, Aug. 10.

Refuse Destruction.—An article abstracting and criticising a paper by Garrett on "Refuse Disposal and the Results Obtained from a Six Months' Working of the Refuse Destructor at Torquay." The results of four tests are given, which, however, were of very short duration.—*Lond. Elec. Rev.*, Aug. 10.

Electric Power in Machine Shops.—PERKINS.—An illustrated description of some modern types of electrically operated machine lathes.—*El'ty*, Aug. 22.

Electric Cranes.—The conclusion of the illustrated serial (Digest, Aug. 25) giving some remarks on brakes for cranes and on crane speeds.—*Lond. Elec. Rev.*, Aug. 10.

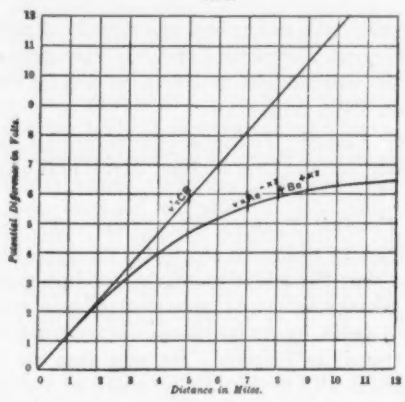
Electric Cranes.—VOGELSANG.—The illustrated paper noticed in the Digest June 9, Aug. 11, on electric cranes operated by several direct current motors.—*Elek. Zeit.*, Aug. 2

Printing Plants.—An illustrated article on Lundell motors for printing plants.—*El'ty*, Aug. 22.

TRACTION.

Fall of Potential Along Tramway Rails.—PARRY.—A mathematical paper, illustrated by diagrams. He remarks that the problem of determining the fall of potential along a tramway line for a given potential difference between the ends is similar to that of a heat conductor exposed to the air, heated at one end and cooled at the other, which problem has been solved by Fourier; similar equations must hold good for both problems. To establish a basis for actual cases, he assumes in the first place a single rail, laid in earth, which is continuous and isolated from any other rail or systems of rails. If an electric current is passed in at one end and taken out at the other end by insulated conductors, a proportion of the current will flow out of the rail between one end and the middle of the rail, and will flow in again along the section between the middle of the rail and the other end. He develops the equations of this case, especially the laws of potential and of current density along the rail, and estimates the constants occurring in these equations. He then plots curves based upon his equations, under the assumption of a maximum current density of 2.5 am-

FIG 3.



VOLTAGE CURVES.

peres per square inch, the current density curve and the potential curve are plotted for lines of 2, 4, 6, 8 miles length. He also gives a curve plotted with the abscissas representing the total distance in miles and the ordinates representing the ratio of the current midway between the two ends (minimum current density) and the current entering or leaving the ends (maximum current density); this ratio is 1.0 at 0 mile, 0.4 at 9 miles, 0.1 at 18 miles, 0.05 at 24 miles. The accompanying figure is a comparison between the voltage required for the same current in the case of a continuous length of rail with no leakage (curve v^1) and the voltage required for the same length of rail under the conditions assumed (curve v), the curve v^1 being, of course, a straight line; the peculiarity of the curve is that for distances exceeding ten miles the value of v increases very slowly. He shows that his curves form the basis of actual conditions, and, as a first approximation, if a correction is made for the resistance of the joints, the total potential difference for any given current is found to agree closely with actual conditions. As in this theory the whole of the resistance to leakage is assumed to be at the contact of rail and earth, the equations are more correct for long lengths than for short ones, as in the latter case the resistance of the earth itself will affect the result.—*Lond. Elec.*, Aug. 10.

Blackpool and Fleetwood Tramroad.—A description of this British tramway, which is 8½ miles in length, double track, and is said to be one of the best paying tramroads in the world, as it runs through a very pretty country. The generator station contains five steam-driven 120-kw dynamos giving direct current at 505 volts; a storage battery sub-station contains a battery of 250 cells, having a capacity of 300 amp.-hours.—Lond. *Elec. Eng.*, Aug. 10.

REFERENCES.

Automobile.—An illustration, with brief description, of an electric automobile, constructed by Davis, driven by two 1-hp motors, connected with the front wheels and working independently of each other; the vehicle it also steered by the front wheels, which swing on pins close to the inside of the wheels, carrying the motors back and forth with them, the connection being made with brass contact plates which allow for the swing of the wheels.—*Sc. Amer.*, Aug. 18.

Automobile.—A communication on a run of an electric automobile of a London company from London to Brighton, a distance of 53 miles, in one day with one charge. Some information on motors, batteries, weight and tests made during the run is given.—Lond. *Elec. Rev.*, Aug. 10.

Automobile.—HERSCHMANN.—The first part of a long abstract of a paper read before the Am. Soc. of Mech. Eng. on the automobile wagon for heavy duty. In speaking of the electric automobile, he agrees that it has great advantages; "there are, however, inherent disadvantages to the use of batteries, which grow prohibitive in a motor

wagon intended to carry heavy weights over a long distance."—*Elec. Rev.*, Aug. 15.

Water Power Plant.—An illustrated description of an auxiliary water-driven plant of the Isle of Man tramways.—*St. R'y Rev.*, August.

Indiana Railway Co.—A long illustrated description of the interurban trolley lines of the Indiana R'y Co., which serve the cities of South Bend, Mishawaka, Elkhart and Goshen.—*St. R'y Rev.*, August.

Geneva.—An article on the new tramway system of Geneva.—*Revue de l'Elec.*, July 31.

Conduit System.—A very brief illustrated article on a new tramway line in Paris, where the conduit system is used.—*La Nature*, Aug. 11.

Inclined Elevator.—An illustrated description of the Reno inclined elevator in the Crystal Palace in London. The inclined floor moves at about 90 ft. per minute and is driven by a 9-hp electric motor.—Lond. *Elec., Elec. Eng.*, Aug. 10.

Accessories of Electric Traction.—COTTRELL.—A continuation of his long illustrated serial (Digest, June 23). This part deals mainly with rheostats. Lond. *Elec. Rev.*, Aug. 10.

Trolley and Conduit Systems.—ROBINSON.—An article reprinted from a daily paper, in which he advocates the use of the trolley system. He thinks that the adoption of the conduit system on electric tramways is a mistake which, if persisted in, may entail loss on the working and will delay, by its costliness of construction, the development of rapid transit in London. He says that the conduit system will be found practically impossible in many of the central parts of London, while its cost will be at least double that of the trolley, and it is naturally liable to more frequent interruption both from physical and climatic causes.—Lond. *Elec. Eng.*, Aug. 10.

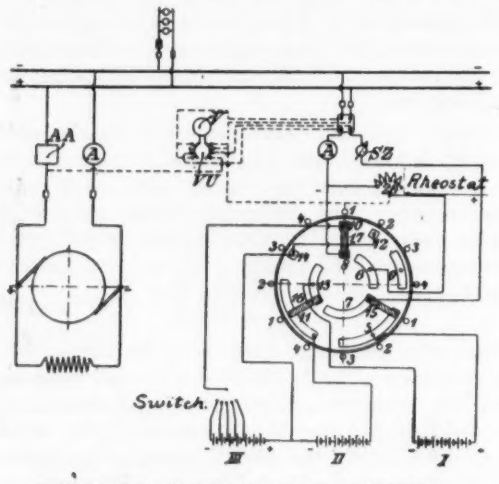
High Speed Trains.—A long abstract of the paper of Gerson comparing electric and steam traction for obtaining high speeds, noticed in the Digest Aug. 11.—*L'Ind. Elec.*, June 25.

Electrolysis of Underground Structures by Tramway Return Currents.—MAURY.—An illustrated reprint in abstract of the paper noticed in the Digest Aug. 4.—*St. R'y Rev.*, August.

British Manufacturing Plant.—An illustrated description of the Electric Railway & Tramway Carriage Works at Preston.—Lond. *Elec. Rev.*, Aug. 10.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Switch for Charging Storage Batteries.—LOEWIT.—An illustrated article discussing different methods for charging a storage battery in a lighting installation. He assumes a battery of 60 cells, giving 100 amperes at 110 volts; the average charging voltage is 2.4 volts; if the



SWITCH FOR CHARGING STORAGE BATTERIES.

battery is divided into two halves, connected in parallel, each half consisting of 30 cells, and the dynamo which is used for charging has also to furnish current at 110 volts to the supply network, considerable resistances must be connected in series with each half, and more than a third of the energy supplied by the dynamo to the cells is wasted in the resistances. He recommends therefore to divide the battery into three equal parts, each of 20 cells, and to charge always two parts in series, i. e., 40 cells, which require 96 volts; therefore only a small resistance is required in series and the energy wasted in this resistance is only 13 per cent of the whole energy supplied from the dynamo to the cells. The supply pressure of 110 volts is sufficient for a full charge of the cells, as the voltage required at the end of the charge is 108 volts; the time required for this method of charging is, however, 1½ times that for charging the two halves of the battery connected in parallel. He describes a simple switch which prevents mistakes in charging always two-thirds of the battery. The switch, which is illustrated in the adjoining figure, consists of three sliding contacts which form always angles of 120 degs. with another and allow four different positions of the switch; these four positions correspond to the discharge of the cells I, II, III, the charging of the parts I, II, the charging of the parts I, III, the charging of the parts II, III. The position for discharge of the cells is illustrated; for the charge of I and II, the three sliding contacts are turned in the direction in which the hand of a clock moves, so that the contact 15 still connects 7 and 5, the contact 16 still connects 13 and 11, while contact 17 now connects 6 and 12; for the charge of I and III, the three contacts are moved farther in the same direction, so that 15 still connects 7 and 5, while 16 now connects 13 and 14, and 17 connects 6 and 9; for the charge of II and III, the three sliding contacts are turned further, so that 15 now connects 7 and 11, while 16 is disconnected and 17 connects 9 and 6.—*Elek. Zeit.*, Aug. 2.

Current Density for Switch Contacts.—EVANS.—A brief illustrated communication on the surface density on the contact points of switches. For laminated contacts, constructed of hard-rolled sheet copper, he allows 400 amperes per square inch; if foliated copper is used, 500 amperes per square inch. For spring contacts, in which the contact surfaces are machined, and the only material used is cast brass, he allows 160 amperes per square inch. For flat cast-brass machined contacts, which can be held together under considerable pressure by a nut or set-screw, he allows 200 amperes per square inch.—Lond. *Elec. Eng.*, Aug. 3.

REFERENCES.

Buenos Ayres.—A continuation of the description (Digest, Aug. 4, 11), giving information on the distribution network, for which triple-cored cables are used, lead-sheathed and steel-armored, on the 50 transformer sub-stations, scattered over all the area and all constructed under the street, and on the tariff.—Lond. *Elec. Rev.*, Aug. 10.

Distribution of Electricity in Hastings.—An editorial discussion of Andrews' paper, abstracted in the Digest Aug. 4. Andrews' paper is also reprinted.—Lond. *Elec.*, Aug. 10.

Gloucester.—An illustrated description of the recently opened municipal direct-current plant of Gloucester; also of the refuse destructor, now under construction.—*Lightning*, July 26; Lond. *Elec. Rev.*, Aug. 3.

Switch Gears for High Pressure Alternating Currents.—The first part of what promises to become a long serial on the evolution of switch gears for high pressure alternating currents. The description is restricted to British types. In the present part he makes some introductory historical remarks.—Lond. *Elec. Eng.*, Aug. 10.

Switchboards.—PERKINS.—The first part of a well illustrated serial on modern switchboard practice. This part deals with polyphase high-tension switchboards.—*West. Elec.*, Aug. 18.

Interrupter.—An illustrated description of an interrupter, devised by Sprecher, for interrupting a transmission line at several points from a distance.—*Schweiz. Blaetter fuer Elek.*, Aug. 8.

WIRES, WIRING AND CONDUITS.

Electric Conductors and Dust.—BAILY.—An article referring to the paper of Swinton, abstracted in the Digest May 19. He agrees fully with Swinton that the effect is due to electrostatic action, but says that Swinton makes an error in talking of positive and negative, as the sign of the potential with regard to the earth is almost without influence on the result. The system in Edinburg is three-wire direct current with the middle wire earthed at the station and 230 volts on each side. Therefore the line wires are positive or negative to earth according as the circuit is connected to the positive and middle or negative and middle. He found that the deposit of dust around fittings or conductors was very small in all cases in which the switch was on the live side; when the switch was on the earthed side, the deposit was always large. No regular difference could be definitely observed in positive or negative circuits, but there was an indication that the deposit was more on the walls on the negative side, while on the positive side the fitting seemed more covered. The effect on the live side is extremely well shown with switches which are fixed in the walls without projecting back blocks of wood. Around all of these

there is a very marked ring of dirt on the wall paper with a thin line of clean paper close to the porcelain base. In drawing rooms or other carefully decorated places, the switch cover should be earthed by being brought down outside the base so as to enclose it completely. No electrostatic effect can then take place, for the charge will leak away to the wall as fast as it leaks over the insulation inside. The insulation of the system is, however, decreased in this way.—Lond. *Elec.*, Aug. 10.

REFERENCES.

Heating of Underground Conductors.—WILKENS.—*A communication* criticizing some points in the paper of Apt, abstracted in the Digest Aug. 25. Some suppositions, made by Apt, are said to be not exact enough for developing a general theory.—*Elek. Zeit.*, Aug. 9.

Grounding Certain Points of Distributing Systems.—A general discussion of this question, with special references to the paper of Wordingham, abstracted in the Digest Aug. 11.—Lond. *Elec. Rev.*, Aug. 10.

Insulating Electrical Conductors.—Some notes on a scheme of Tesla, to insulate an electrical conductor by surrounding it with some substance which acts as a perfect insulator when frozen, and to circulate a cooling agent through one or more channels extending through the substance.—*El'ty*, Aug. 22 (See ELEC. WORLD, Aug. 25).

ELECTRO-PHYSICS AND MAGNETISM.

Continuous Discharges in Air.—TOEPLER.—An account of an investigation of the continuous discharge obtained from an influence machine, in air at atmospheric pressure as dependent upon the current; the discharge may appear in four different forms: glow, brush, brush-arc, and flame-arc. As a general rule an increase in the current brings about a transition from the glow to the brush and finally to the brush-arc, but this transition is not continuous unless the capacity in the circuit is negligible. Otherwise the three continuous stages are separated by stages of discontinuous spark discharge, and as the capacity increases the discontinuous stages encroach until the brush-arc is almost entirely eliminated. He deals at length with two forms of natural continuous discharges: the St. Elmo's fire and globular lightning. The latter is explained as follows: An ordinary lightning flash leaves behind it a track of comparatively highly conducting air. A continuous and slow discharge passes along that track for some time after the flash; occasionally a place occurs in the track where there is a high resistance, and when the quantity discharged is adequate, this place glows and continues to glow while the slow discharge proceeds. This luminous space is the globe lightning.—*Ann der Phys.*, No. 7; abstracted and commented upon editorially in *Lond. Elec.*, Aug. 10.

Spark Length as Modified by Dielectrics.—HUMPHREYS.—An account of experiments which show that the spark length is greatly modified by the presence of solid dielectrics, such as glass or ebonite, at certain points near the positive pole. He uses two small Leyden jars, the outer coatings being connected by a wire, the inner coatings to two discharging balls, which are connected also one to the positive, the other to the negative side of an influence machine; the distance between the two discharging balls is gradually increased till sparks cease to pass. If now the potential difference be maintained and a glass rod be placed quite near that side of the positive pole that faces the negative, the air will in general break down and allow a full noisy spark to pass. Nothing of the kind happens when the rod is placed next the negative pole, or in fact in any part of the field other than that very near the anode. Various solid dielectrics have been used, all giving the same general result. The increase in spark length is usually very pronounced, often more than doubling the maximum length obtainable under ordinary conditions. He sugggests the following hypothesis: the dielectric between two poles is most sensitive to electric disturbances at points next the anode.—*Phys. Rev.*, Aug.

Resistance of Thin Films.—LONGDEN.—The conclusion of his paper on the electrical resistance of thin films deposited by cathode discharge (Digest, Aug. 11). He reaches the following conclusions: The process of depositing metals by cathode discharge is probably simply distillation, in which the vaporization of the cathode is largely due to its electrification. The temperature coefficients of the very thin films are negative, and for films within a certain range of thickness, the temperature coefficients are approximately zero. The necessity of artificial aging is proportional to the magnitude of the temperature coefficient.—*Phys. Rev.*, Aug.

Uranium Rays.—BECQUEREL.—An account of the following experiment: When uranium chloride is mixed with barium chloride, and the barium is precipitated as sulphate, the latter takes down with it the greater part of the radio-activity of the uranium. He has repeated the same process eighteen times, but has not yet succeeded in obtaining "inactive" uranium.—*Comptes Rendus*, July 16; abstracted in *Lond. Elec.*, Aug. 10.

Lightning.—ROLLINS.—With reference to the note in the Digest Aug. 4, Mr. Rollins sends a photograph of the lightning flash, mentioned there. It clearly shows to the left of the flash a dark band along the whole length of the flash. He remarks that this dark band cannot be accounted for by reversal or any similar photographic result, and concludes that it really existed in the sky. It is "a place in the ether swept so nearly clean of matter that it neither conducts nor shines well."

Effect of Magnetization Upon the Modulus of Elasticity.—STEVENS.—A continuation of his investigation (Digest, Sept. 2, 1899). He gives an account of experiments on the relation between magnetization and the modulus of elasticity of traction. This modulus increases when the body is magnetized, the increase being fairly proportional to the magnetizing force; with the same wire the change in the modulus varied with the stretching weight. With wires of different cross sections, stretched by the same load, the change in modulus was greater with the smaller wire. Also experiments were made on the relation between magnetization and elesaticity of compression; within the limits of the experiments magnetization did not change the elastic modulus for compression.—*Phys. Rev.*, Aug.

REFERENCES.

Oscillating Discharges.—NECULCEA.—A long article giving two contributions to the mathematical theory of the oscillating discharges, the first dealing with the resistance and reactance of a wire in an oscillating discharge, the second with oscillating discharges of a condenser. The article is of a highly theoretical nature.—*L'Eclairage Elec.*, June 30.

Electro-Photographic Experiments.—NIPHER.—A well illustrated account of experiments. Electro-photographs of two medals are reproduced. He describes experiments in which he obtained a slow-moving ball discharge, somewhat analogous to ball lightning. He also made experiments with over-exposed plates in X-ray and ordinary photography.—*Transact. Acad. of Sc. of St. Louis*, Vol. 10, No. 6; *Lond. Elec. Rev.*, Aug. 10.

Roentgen Rays.—ROLLINS.—A continuation of his very long serial, giving a note on "which way does the current flow?"; also a note on the relation between gas amalgamation and Tesla light. Finally he describes the arising of a lightning storm, which began quietly with glow discharges, forming out of the pure sky.—*Elec. Rev.*, Ang. 8.

ELECTRO CHEMISTRY AND BATTERIES.

Electrolytic Production of Zinc with By-Products at the Anode.—RONTSCHEWSKY.—An account of an experimental investigation, made to devise methods for obtaining valuable by-products at the anode, in the electrolytic production of zinc with the use of insoluble anodes. He remarks that the difficulties involved in the electrolytic production of bright solid zinc from solutions of zinc salts with insoluble anodes, can be overcome by special precautions, as by adding free acid and using a proper temperature, and a proper current density at the cathode. As electrolyte, a solution of zinc sulphate is used, containing some sulphuric acid, and a lead anode is used, which is insoluble in the electrolyte. To utilize the anode material in any way, it must be first dissolved, which can be accomplished by adding to the electrolyte such a compound, which, when dissociated by electrolysis, gives an ion which dissolves lead. He added chlorate of sodium. Among other processes, the following reactions can occur at the anode: chlorate of lead is formed, then lead sulphate, then peroxide of lead. He has made an investigation of the two cases, that small or great quantities of chlorate of sodium are added to the electrolyte. If a small quantity of chlorate of sodium is added, he found that under special conditions of temperature, current density and concentration, zinc was obtained at the cathode in a solid form and of such a bright color as could not be obtained by electrolysis of sulphate of zinc, free of chlorate. The anode was covered with a soft layer of peroxide of lead and there was a continuous "rain" of powder of peroxide; by knocking at the plate, greater quantities of peroxide broke off and fell down. After ten hours of electrolysis with 1 amp. per sq. decimeter, at 15 degs. Celsius, and with 0.75 per cent of chlorate of natrium, the zinc and the peroxide of lead were tested as to purity; the zinc was found to be entirely free of lead, the peroxide was found free of lead

sulphate. He concludes that in this way peroxide of lead can be obtained as a by-product in the electrolytic production of zinc. In the case that great quantities of chlorate of sodium are added, a diaphragm was necessary to get pure zinc; as by-product he produced chromate of lead at the anode. The chromate obtained by an electrolysis of twelve hours was very fine and of beautiful color, which, although not chemically pure, seems well adapted for use as paint; the zinc obtained at the cathode was solid and bright, and entirely free of lead.—*Zeit. fuer Elektrochemie,* July 19-26.

Pasted Storage Battery Plates.—PETERS.—An account of experiments with pasted plates. For the preparation of the lead oxides which are to be filled into the grid, often sulphuric acid is used; lead sulphate is thus produced, which causes a close joining between the particles of lead oxide and gives a strong, solid, active mass. It has, however, been known for a long time that also distilled water may be used for the preparation of the lead oxides. He has made a systematic investigation to determine which of these two methods is preferable. The results are given in tables and diagrams, and are summed up as follows: By using distilled water a more porous active mass is obtained than by using sulphuric acid. The porosity of pasted plates, prepared with distilled water, is best, if the pastes are dried before they are brought into the sulphuric acid of the storage battery or into an acid of different concentration. The capacities and the quantities of energy obtained in discharges are more uniform for different rates if the pastes are prepared with water than if prepared with sulphuric acid. If they are dried before being brought into sulphuric acid, pastes prepared with water give better peroxide of lead plates than plates prepared with sulphuric acid; the spongy lead plates obtained by preparation with water, however, are not quite as good. If the pastes prepared with water are brought into the sulphuric acid for formation before they have been dried, there is a greater amount of swelling of the negative mass than if the pastes had been dried before. Pastes prepared with sulphuric acid show a tendency to sulphating during formation.—*Centralblatt fuer Accum. und Elem. kunde,* July 1, Aug. 1.

Electrolytic Bleaching.—IMHOFF.—An article on the production of bleaching compounds by the electrolysis of solutions of the alkali metal chlorides or of magnesium chloride. Secondary processes prevent a good economy of the process; it is especially necessary to devise the apparatus so that there is no reduction of the compounds already formed by the hydrogen produced at the cathode. He recommends to add a small percentage of soluble chromates to the electrolytic; the effect of this method is that the hydrogen escapes in gaseous form from the solution, so that there is no reduction.—*Elektrochem. Zeit.,* July.

REFERENCES.

Transference Number.—KENDRICK.—An account of a determination of the transference number of hydrogen ions in solutions of sulphuric acid of different concentration by a new method. He uses the plates of the lead storage battery as electrodes in concentration cells and measures the e. m. f.; if the curve of the e. m. f. is known, the transference number of hydrogen can then be calculated by means of a formula based upon thermodynamical considerations.—*Zeit. fuer Elektrochemie,* Aug. 2.

Synthesis of Organic Substances.—DONY-HENAULT.—The second, concluding part of his paper on the synthesis of organic substances by electrolysis (Digest, June 9), dealing with the synthesis of iodoform; its formation either by a purely chemical or by an electrochemical method is a secondary process.—*Zeit. fuer Elektrochemie,* Aug. 2.

Storage Batteries.—An article by Blochmann, on the storage batteries exhibited in the small electrical exposition, which was recently held in Kiel at the annual meeting of the Union of German Electrical Engineers; especially storage batteries for use on shipboard were exhibited.—*Centralblatt fuer Accum. und Elem. kunde,* July 1.

Gas Battery.—HABER.—A theoretical paper on peroxide of hydrogen, self-oxidation, and the gas battery.—*Phys. Zeit.,* June 30.

Electrogalvanizing Boiler Tubes.—An article on the use of electrogalvanizing for the protection of boiler tubes, with an illustration of a Cowper-Coles regenerative plant.—*Eng'ing Elec. Rev.,* Aug. 15.

Electorchemistry.—PERKIN.—A reprint of the illustrated English article on the advancement of electrical chemistry, noticed in the Digest July 21.—*Sc. Amer. Sup.,* Aug. 18.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Determining Battery Resistance.—AUSTIN.—A note describing a modification of the Wheatstone bridge method of Mance for determining the resistance of a battery cell. The main difficulty in the use of this method lies in the fact that at each observation the battery circuit must be kept closed long enough for the galvanometer to come to rest, which in the case of open circuit batteries gives ample time for the errors due to polarization to appear, unless large resistances are inserted in the bridge, thus reducing the sensibility of the method and rendering impossible the use of the convenient slide wire bridge for such cells. He advocates the substitution of a low resistance telephone in place of the galvanometer; it possesses the advantages that it responds only to the changes of the current, and is always ready for an observation. Some hints are given how to carry out this modified method.—*Phys. Rev.,* Aug.

Rate Meters.—HENDRICKSON.—A brief paper read before the Pac. Coast Elec. Transm. Ass'n. He believes maximum-demand meters to be unjust, because they indicate the highest demand made on a station if but once in the whole period between readings. A perfect rate meter should be automatic and thereby register the lowest rate demanded, and should not register the maximum rate until that demand has been made a sufficient number of times to make it necessary to set apart a definite portion of the installation to meet that demand. Such a rate meter, in a water-power plant, where the fixed charges greatly predominate, meets all wants satisfactorily, while in plants where the generating and distributing costs are high a recording watt-hour meter is a necessary adjunct to the rate meter. He recommends a rate-indicator recently patented by Harris, which consists of a solenoid attracting an iron core, the pull on the core being opposed by a weight carrying a pointer in front of a scale arranged by means of a pawl and rack to travel out on an arm. When the pull of the solenoid is sufficient to overcome the weight the arm raises and the pawl attached to the weight advances one notch in the rack.—*El'ty,* Aug. 15.

REFERENCES.

Applications of the Chronograph for Electrical Measurements.—MAREK.—An illustrated article in which he shows that the chorono-graph, recording small time intervals, which has been used for many years for astronomical measurements, can be used to advantage also for electrical measurements, for instance for testing motor meters, for determining the frequency of an alternating current, for determining the period of the oscillations of galvanometers, etc.—*Elek. Zeit.,* Aug. 2.

Determining the Counter E. M. F. of Electrolytic Baths.—Four communications describing several methods.—*Lond. Elec. Eng.,* Aug. 10.

Wheatstone Bridge.—A reprint of the illustrated description of a workshop from the Wheatstone bridge, devised by Fleming (abstracted in the Digest, April 21).—*West. Elec.,* Aug. 18.

TELEGRAPHY TELEPHONY AND SIGNALS.

Long Distance Telephony.—A note on experiments which were made on an actual submarine cable: for a length of cable of 63 knots, K. R. 7,900 the speaking was good, the volume of sound ample; for a length of cable of 84 knots, K. R. 13,900, the conversation was easy, but on the commercial limit. These experiments were made with ordinary good telephonic apparatus, not with a specially powerful form, and were made under actual conditions such as would occur in practice. It is remarked that the K. R. law cannot be rigidly accepted as being correct in its simplest form.—*Lond. Elec. Rev.,* Aug. 10.

Long Distance Telephony.—Some editorial notes on Pupin's A. I. E. E. paper. His result that there should be several coils in a half wave length is said to be a conclusion which must be fairly obvious from Heaviside's writings. It is thought that as one of the factors from which this wave length has to be calculated cannot be predetermined with extreme accuracy (namely the inductance of the cable), it follows that the number of coils per mile will always have to be determined more or less by experiment.—*Lond. Elec.,* Aug. 10.

REFERENCES.

Long Distance Telephony.—WADE.—An article on Pupin's system.—*Eng. News,* Aug. 23.

Germany.—A very long and full statistical article on the development of telephony in Germany.—*Elek. Zeit.,* Aug. 9.

Indiana.—A map, with brief description, of the independent long-distance telephone lines in Indiana.—*Elec. Rev.,* Aug. 15.

Faults on Telephone Circuits.—A reprint of the illustrated English article abstracted in the Digest Aug. 18.—*El'ty,* Aug. 15.

Multiple Telegraphy.—MUNIER.—An illustrated description of two systems devised by him.—*L'Eclairage Elec.,* July 21.

Interception of Wireless Telegrams.—TOMMASI.—A reprint of the English translation of the French paper, noticed in the Digest Aug. 4, July 7.—*Elec. Rev.,* Aug. 15.

French Cable Projects.—An article, with a map, giving a summary of the report of the commission appointed to examine the question of the establishment of a system of submarine telegraph lines to connect certain French colonies with the mother country.—*Lond. Elec.,* Aug. 10.

Block Signals for Tramways.—An illustrated description of an automatic block signal system, devised by Bancroft and Sullivan, and used on two trolley lines in Mass.—*St. R'y Rev.,* Aug.

MISCELLANEOUS.

Union of German Electrical Engineers.—A full account of the proceedings at the recent annual meeting in Kiel. The annual report, by Kapp, on the work of the Union, is reprinted; also the regulations for electric railways, with the trolley system or with storage batteries in the cars, using a voltage between 250 and 1000; also the regulations for electric installations in theatres; also the regulations for the electric illumination of show windows and of rooms for storing inflammable materials; these three sets of regulations were accepted as provisory rules for one year and will be voted upon again next year. The reports of the different commissions for regulating the inspections of electric installations, for testing materials, for standardizing incandescent lamp bases and sockets, for investigating the hyteresis of different sorts of iron, for treating economical and legal questions, are reprinted; also a report, by Katz, on the patent congress in Frankfort. A new commission was installed to formulate regulations for testing wires and cables.—*Elek. Zeit.,* Aug. 2. In a continuation of an account of the proceedings an abstract of the paper of Wedding on the Bremer arc light (Digest July 28) and some information on the use of electricity in the German Navy is given in *Lond. Elec. Eng.,* Aug. 10.

REFERENCES.

Electric Heating.—ADAMS.—An article on the possibilities of electric heat as limited by the cost of production. Electric heat is very convenient for various small processes, where the value of the amount of heat consumed is trifling compared with the necessity for its delivery in a certain place at an exact time. He shows that the use of electric heat is limited to such processes, and that the investment in machinery is so great for electric heat that it is entirely impracticable for general use, even with free fuel or water power for its production..—*Eng. News,* Aug. 23.

Tesla.—WRIGHT.—An illustrated article on "Some Novel Inventions of Nicola Tesla." He describes an electrolytic meter, several anti-sparking brush devices, and models of a thermomagnetic motor and of a pyro-magnetic generator.—*Lond. Elec. Eng.,* Aug. 10.

Electrical Engineers in the War.—A letter describing the service of the electrical engineer volunteers at the front in South Africa.—*Lond. Elec.,* July 27.

Metal Market.—Diagrams showing the fluctuations of the price of zinc, lead, iron, tin, copper during the month of July.—*Lond. Elec. Rev.,* Aug. 10.

Paris Exposition.—VIGNERON.—A brief illustrated article on the competition of automobiles, which was held in May; no electric automobiles took part.—*L'Eclairage Elec.,* June 30.

NELSON-UHRY.—A brief illustrated article on inclined elevators, exhibited by LeBlanc.—*L'Eclairage Elec.,* June 30.

GUILLAUME.—An illustrated description of the electric block signal system, exhibited by Krizik, Prague.—*L'Eclairage Elec.,* July 7.

REYVAL.—A long, well-illustrated description of a 600-kw three-phase alternator, exhibited by Grammont, with a Hutin and LeBlanc compound exciter (ELEC. WORLD AND ENG., Aug. 18, p. 242).—*L'Eclairage Elec.,* July 28.

GUILLAUME.—An illustrated description of a method of Fischer-Hinnen for starting induction motors, among the exhibits of Krazik, Prague. (See the abstract under Dynamos).—*L'Eclairage Elec.,* July 28.

GUILBERT.—A well-illustrated description of a 750-kw two-phase alternator, with Hutin & LeBlanc's amortisseurs, exhibited by Farcot.—*L'Eclairage Elec.,* July 14.

MUNIER.—An illustrated description of two systems of multiple telegraphy, devised and exhibited by Munier.—*L'Eclairage Elec.,* July 21.

An illustrated description of an automobile motor exhibited by the United Elec. Co., of Vienna. Also a brief description of incandescent lamps exhibited by Sturm & Co.—*Zeit. fuer Elek.,* June 10.

DAVID.—A continuation of the article (Digest, July 7), giving a summary of the storage batteries exhibited.—*Centralblatt fuer Accum. und Elem. kunde,* July 15.

An illustrated article on the electric lighting of the Exposition.—*Zeit. fuer Elek.,* July 15.

ANIZAN.—An article on the telephonic exhibits.—*Jour. Tel.,* July 25.

An illustrated article on street railway exhibits and on the transportation at the Exposition.—*St. R'y Rev.,* Aug.

DEMORSIER.—An article on dynamos and motors exhibited by Rieter.—*Revue de l'Elec.,* July 31.

BOYER.—The first part of an illustrated article on the historical electrical museum at the Exposition.—*Cosmos,* Aug. 11.

BORCHERS.—The first parts of a very full account of the electrochemical exhibits. He begins with the minerals, produced in different countries, and treats in the present parts the mineral products of France and the French colonies—New Caledonia, Algiers, Madagascar—of Great Britain and the British colonies—Canada and Western Australia. The article contains a very great amount of statistical information.—*Zeit. fuer Elektrochemie,* July 26, Aug. 2, 9.

A brief description of a storage battery, exhibited by the Accumulator Man. Co., of Berlin, giving 50,000 amp. hours if discharged in 10 hours, and 25,000 amp. hours, if discharged in 1 hour, the price being $1875.—*Centralblatt fuer Accum. und Elem. kunde,* July 1.

A continuation of the description by David of storage battery exhibits. Also a separate description of the exhibit of the Pollak Storage Battery Co., of Frankfort.—*Centralblatt fuer Accum. kunde,* Aug. 1.

A continuation of the illustrated serial, describing exhibits of Lahmeyer & Co., Frankfort.—*Lond. Elec. Eng.,* Aug. 10.

New Books.

DAS PUMPENVENTIL. By Otto H. Mueller, Jr. Liepsig. Published by Arthur Felix. 157 pages, 41 illustrations. Price, 5 marks, paper; 6 marks, cloth.

A treatise on the theory and design of valves used in pumping machinery for handling inelastic fluids, like water, oil, etc. It claims to be eminently practical as well as suited to the use of students, but inasmuch as all deductions are based on the assumption that the valve is without mass and as the values of many constants are omitted, its scope of usefulness is likely to be a restricted one. The author frankly states that he disagrees with all other authorities, but claims that wide experience in pump design bears out his theories. The work will probably be found to interest specialists in pump design alone.

UEBER DIE AENDERUNGEN DER STROMFORM EINES NORMALEN WECHSELSTROMES DURCH GRÄTZSCHE ALUMINUMZELLEN. By Dr. Gottfried Mayrhofer. Rosenheim, 1900: M. Niedermayer. Paper, 40 pages; 12 illustrations.

This pamphlet, as indicated by its title, deals with certain investigations regarding the modifying effect of the aluminum cell on alternating current wave forms. It describes first the apparatus and method used by this investigator, which consisted in photographing the path described by a cathode ray as moved by the magnetic field produced by a solenoid through which the current investigated passed. His photographs show vertical lines of varying brightness at different points and not actual curves, as he found that when the latter were visually produced through the aid of the well-known rotating mirror device, the light intensity was too feeble to effect sensitive films even when the exposure lasted for many hundred seconds. Curves are, however, given with the photographs, these having been sketched by hand by the author and assistant.

The investigations cover but three types of cells, one consisting of aluminum and lead plates in a bichromate of sodium solution, one of the same plates in a bichromate of potash solution, and the third of

an aluminum and carbon plate in an alum solution, the current strengths being varied through a small range in each case.

The experiments seem to indicate that only with the two former does it become possible to absolutely suppress one-half of the alternations, and even then only after a certain current density per electrode is exceeded.

It was further found that the suppressing effect of the first cell of a series is much greater than that of the second, and the second than that of the third, etc. Brief remarks are made regarding the phenomena of luminescence of the electrodes and on the humming sound given out by the cells on higher current densities. The facilities for investigation seem to have been very limited but skillfully utilized.

HANDBUCH DER ELEKTROTECHNIK. Vol. IV. Ein und Mehrphasen Wechselstrom Erzeuger. By Dr. F. Niethammer. Published by S. Hirzel, Leipsig. 328 pages, 656 illustrations, Price, 18 marks.

This volume, the fourth of a series to be written by various prominent authorities and designed to cover the whole field of electrical engineering, treats, as its title indicates, of single and multiphase alternating-current apparatus. Its threefold purpose, set forth by the author in his preface, namely, to gather together and classify the scattered references to the subject, to state the experiences of the workers in the realm of alternating-current engineering, and to give examples of machines as practically built, has been attained in a very satisfactory degree.

The first pages of the book give a brief historical resumé, valuable chiefly in showing the various different forms that an alternator may take. There then follows a series of sections on the theoretical side of the science which lead up to others, giving various practical formulae for electrical and magnetic design. The many numerical examples accompanying these, and the comparisons of calculated results with dimensions and data taken from machines already on the market, are of great value to the student and engineer.

Good as these chapters are, the next succeeding and final series occupying nearly one-half of the volume are apt to meet with even more favor among those who have to design and build alternating-current machinery. They contain nearly 300 half-tone perspectives and line cuts of sections and details of dynamos, many quite fully dimensioned and showing such particulars as brush rigs, methods of securing windings in place, ways of ventilating and cooling, etc., etc. Almost all of the machines so treated are the product of continental firms, but it would seem that the book should be of more interest to American manufacturers for just that reason.

If the rest of the series of volumes prove as good as this one, the set will be one of the best for ready reference to matters in the electrical field obtainable, and should find a place in the library of every engineer who is fortunate enough to be familiar with the German tongue. It may be added that such eminent authorities as Arnold, Fischer-Hinnen, Jackson, Kapp, Steinmetz, and others were consulted by the author in writing this volume.

Directory of Electrical Societies, Etc.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Next meeting, New York, Sept. 25, 26 and 27, 1900.

AMERICAN STREET RAILWAY ASSOCIATION. Next meeting, Kansas City, Mo., Oct., 16, 17, 18 and 19, 1900.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Next meeting, Saratoga, N. Y., Sept. 4, 1900.

CANADIAN ELECTRICAL ASSOCIATION. Next meeting, Kingston, Ont., Aug. 29-31, 1900.

NATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Next meeting, Pittsburg, Pa., Sept., 25, 26 and 27, 1900.

Standards of Light in Photometric Work.

It has long been argued that if a dissimilarity in color exists between the standard of light adopted and the light being tested, accurate results are impossible. This has led to the use of photometers having arrangements for two incandescent lamps, one the standard and the other the one under test, necessitating the duplication of much of the electrical apparatus and considerable vigilance on the part of the operator to keep the standard at proper voltage. Furthermore, although low efficiency lamps are employed, there is a gradual falling off in candle-power during the constant use to which they are subjected with corresponding inaccuracies in the results. By checking standards of e. m. f., resistance, etc., against secondary standards and using the latter in the actual tests, laboratories have been able to keep their standards from deterioration. The Electric Motor and Equipment Company, Newark, N. J., by similar methods produces extremely satisfactory results with its Deshler-McAllister photometer. In this apparatus the secondary standard consists of a specially designed, double-wick oil lamp which has a flame of a color differing but slightly from that of the incandescent filament. This is adjusted against the standard electric lamp until the flame gives a candle-power corresponding to the indications of the scale. The lamp to be tested is then substituted for the standard lamp, where, being on the same side of the photometer screen, it produces the same discrepancy between actual and apparent results, and the small error from non-uniformity of color is eliminated. Similarly, owing to the fact that the secondary standard of light is photometrically adjusted to the primary standards of light according to the conditions of light prevailing in the room where readings are taken, a specially prepared dark room is not absolutely essential, as frequent checkings of the secondary standard will adjust the apparatus to any possible change of conditions in the surrounding light.

Fuse Wire and Fuse Links at Paris.

One of the most interesting parts of the exhibit in Electricity Building at the Paris Exposition is the collective display made by the U. S. Commission, through Director Drake. This exhibit in the Suffren gallery has already been illustrated and described in general in these pages, in more than one article. A large part of the exhibit consists of sample boards placed along the back wall of the space, and so arranged that the visitor can pass easily up and down the whole length within the rail, to make an examination. We have shown some of these boards, and now illustrate that of the Chase-Shawmut Company, of Boston, of its fuse wire, fuse links and enclosed fuses. As will be noted, a most comprehensive display is made on the board, the pieces being neatly and artistically grouped, with links at the top and in the center, coils of wire at the bottom on the left and enclosed fuses on the right. The variety of sizes and styles of these popular standard auxiliaries of the art is quite surprising, and the collection attracts no small amount of admiring attention.

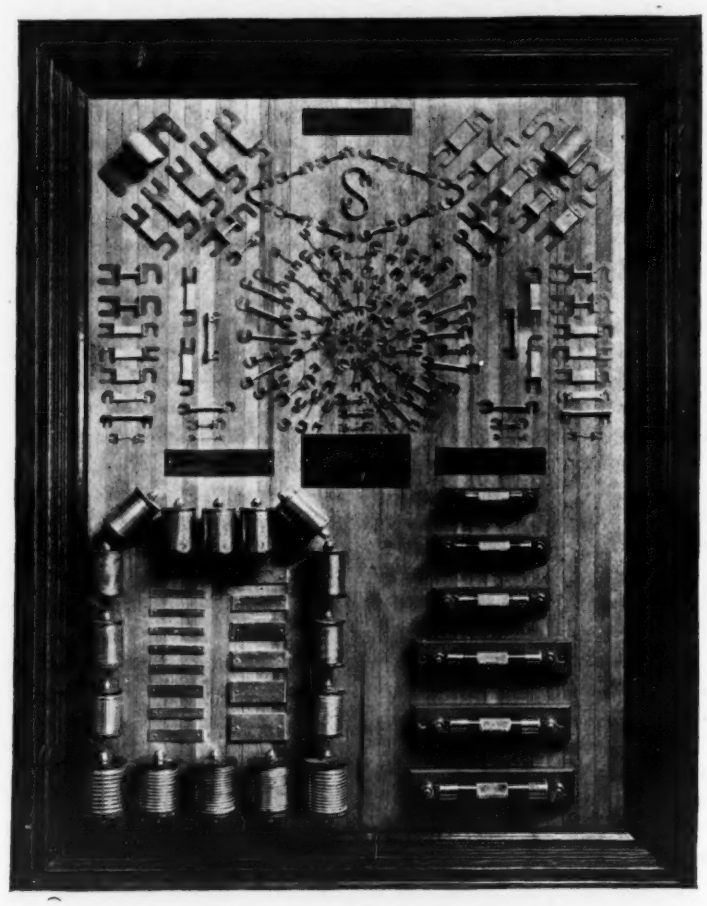
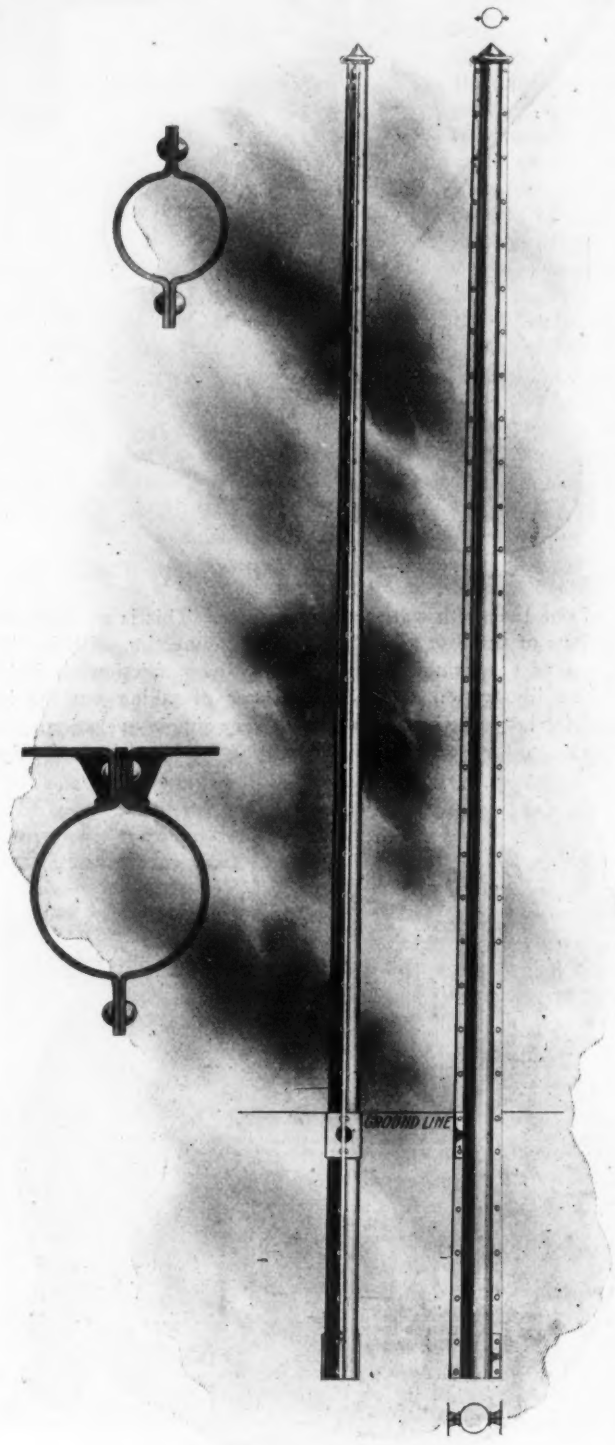


EXHIBIT OF FUSE WIRE AND FUSE LINKS.

Pressed Steel Trolley Poles.

The accompanying illustration shows a trolley pole of pressed steel recently brought out by the Pressed Steel Car Company, Pittsburg, Pa., after a considerable period of experimentation. As will be seen, the pole consists of two pieces of steel, each of semi-circular form, with flanges thoroughly riveted together, thus giving maximum strength throughout its entire length. An important feature of this pole is the added strength at the ground line. Just below the ground



STEEL TROLLEY POLE.

line a bracket is placed on one side at the point where the pole enters the earth, another being placed at the foot but on the opposite side, thus giving the greatest possible resisting force. A malleable iron cap is placed at the top of the pole, but if desired this cap can be made of cast iron. It is quite obvious that this form of construction gives a pole of great strength, the longitudinal flanges giving a degree of stiffness that can hardly be approached in any other form. While extraordinary strength is thus secured, the pole is comparatively light, and possesses sufficient flexibility to meet any accidental strain that may be put upon it without danger of breaking or permanent distortion. For the construction of these poles, dies have been prepared so that poles of any length between 24 ft. and 40 ft. can be turned out.

American Water Wheels in Norway.

The illustrations on this page show the hydraulic machinery of a large new power transmission plant near Christiania, Norway. The plant is now in successful operation, with an equipment of turbines installed by the American Impulse-Wheel Company, New York. At

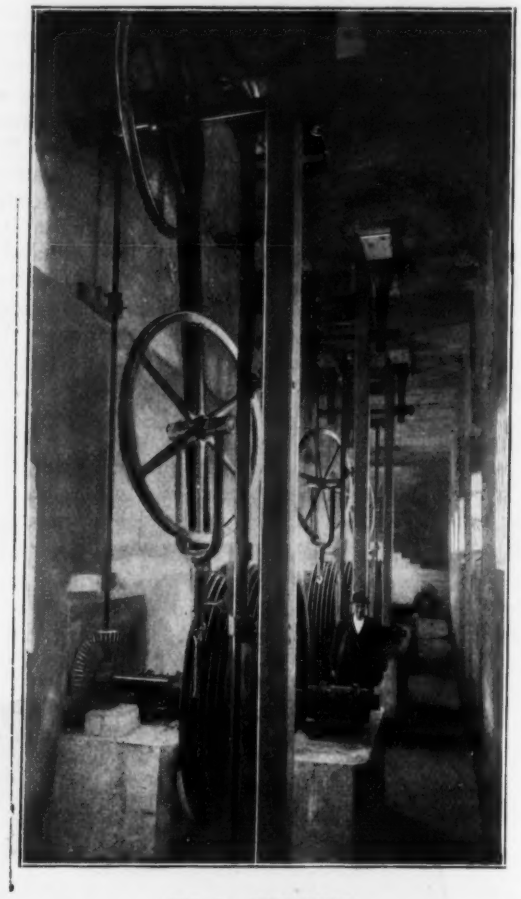


FIG. 1.—ROPE DRIVE.

present there are four units, consisting of double pairs of 24-in. turbines placed on a single shaft, but when the installation is complete it is expected that this capacity will be increased. The water wheels are placed in open flumes about 20 feet below the floor of the generator room, there being a separate flume and bulkhead for each set.

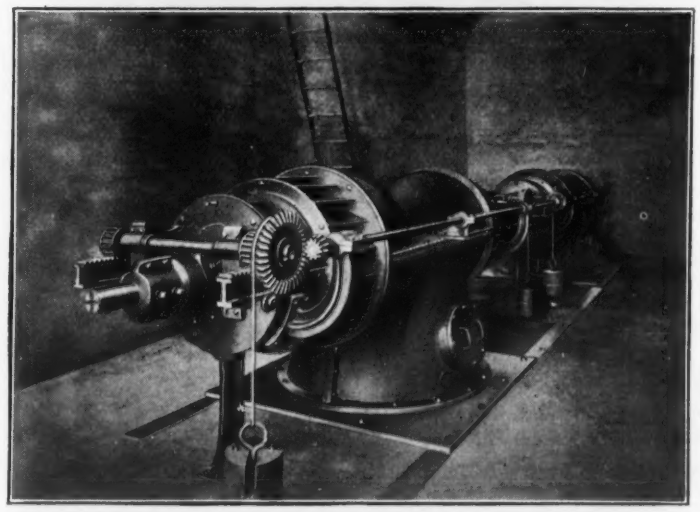


FIG. 2.—INTERIOR OF POWER HOUSE.

They are mounted on steel I-beams imbedded in a cement floor. The shafts on which the double pairs of turbines are mounted are carried through stuffing boxes in the bulkhead wall to a corridor which runs

the entire length of the power-house (Fig. 2). The generators above are rope driven from rope wheels mounted on the ends of the shafts in this corridor. A single rope is used, the pulleys with a single grove serving to keep it tight. Between the driving pulley and the bulkhead wall a bevel gear is mounted on the wheel shaft for operating the mechanical governor. The average head of water is about 13 feet and the wheels are designed to run at 210 r. p. m. They are of the cylinder gate pattern, each set developing about 200 hp. The entire equipment, including shafts, rope wheels for both turbine and generator shafts, governors and headgates, was supplied by the American Impulse-Wheel Company.

Improved Scheeffer Induction Meter.

The illustrations herewith show the construction of the new improved type of the Scheeffer alternating-current recording wattmeter, manufactured by the Diamond Meter Company, of Peoria, Ill. This improved meter is designated as type "E." The previous types have already been described in these pages. The present meter has been reduced in size and weight. The type which the company has been manufacturing weighs about 18 lbs. This has been reduced, with a sheet metal case, to 11 lbs. Cast-iron cases are furnished when desired, but this will add one or two pounds to the weight. The meter is sealed at the factory and is ready for installing without any further adjustment, as all connections are on the outside and it is not necessary to open the meter. They are made perfectly dust- and bug-proof.

One great trouble in motor meters has been the deterioration of the jewel and bearing, due to the heavy moving element, which, under the pulsating alternating current of considerable strength, would wear away the polish of the jewel and bearing, causing increased friction. While this, as a rule, does not affect the full load

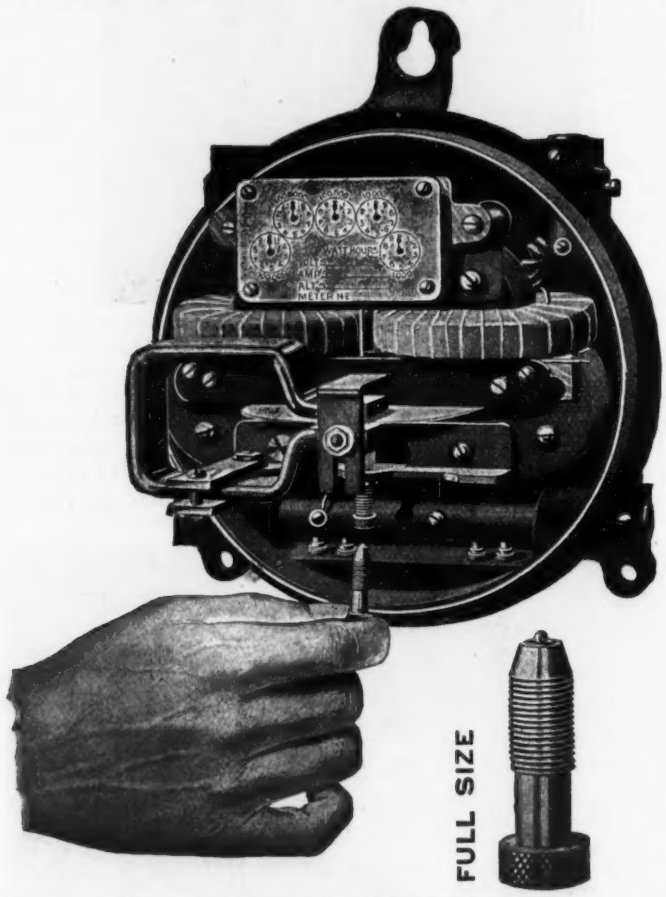


FIG. 1.—INTERIOR VIEW OF SHEEFFER METER.

of the meter, it will cause the meter to lose its sensitiveness because of increased friction of its bearing, and therefore become slow on light loads, or even not register. Of late a number of devices have been adopted to overcome these defects. Mr. Scheeffer has adopted the method of making the moving element very light. This consists of a very thin aluminum disk with a shaft of light brass tube, the whole weighing but 12 grammes. In the second place, he rests this moving element on a highly-polished and hardened steel ball contained in a sapphire cup. The advantage of this form of bearing is that the steel ball can be made very accurate, is always self-centering, and can at any time be quickly replaced by a new one in connection with the jewel, giving the meter a new bearing without any change or even disturbing the full load calibration. Third, the disc is subjected to so slight a force from the shunt that there are no vibrations produced.

The laminated iron magnets with the shunt coils are so constructed that the magnetic flux from them is mostly shunted through an iron mass, very little of the magnetic flux passing to the disc. As the total current consumed by the shunt magnets is about one watt, and only one-twentieth of this is allowed to pass through the disc,

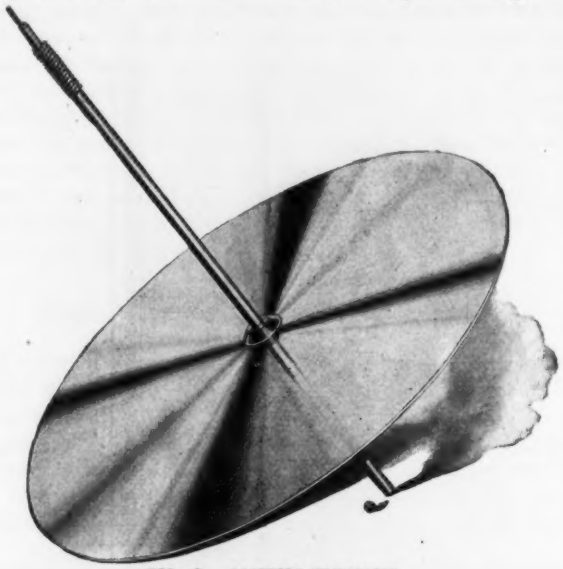


FIG. 2.—MOVING ELEMENT.

a force of one-twentieth watt acts on the disc. This is so slight that no vibrations of the disc take place and, in connection with its light weight, makes a bearing which remains almost frictionless indefinitely. The illustration shows the manner of taking out the ball and jewel for inspection or replacing—a very simple operation.

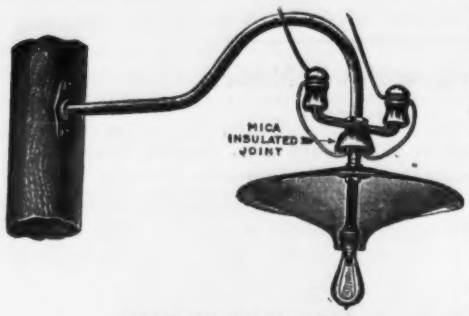
The series coil which carries the lighting load consists of only a

FIG. 3.—GENERAL VIEW OF METER.

few turns of thick wire and is coreless. The loss and drop through it is too small to be ordinarily measured, as the total loss in the meter at full load is two or three watts. This also admits of the meter being overloaded 50 per cent without any alteration of accuracy. The meter responds quickly to sudden loads because of its light moving element, and this feature also makes it extremely sensitive, and a meter of ordinary size will register correctly a 2-cp lamp. The meter is direct reading, no constant being employed. It is also correct on any inductive or non-inductive load.

Improved Street Fixture.

The importance of handsome and strong street fixtures for incandescent lighting service is becoming more and more recognized by those who do work of this character; and the nature of the fixture has a great deal to do with the popularity and success of this method of illuminating thoroughfares and highways. The Wheeler Reflector Company, of Boston, has given the matter special attention, as our readers are well aware, and its literature is part and parcel of the trade library of every progressive central station manager, while its successive improvements are watched with much interest.



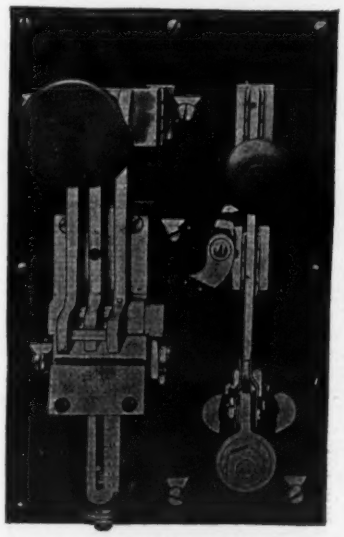
STREET LAMP FIXTURE.

Among its recent novelties in this field is the Wheeler improved street fixture, herewith shown. It is thoroughly insulated from the rest of the fixture by means of a solid mica insulating joint made specially for this purpose. The shade is also an improved design, the curve making it much stronger than has been usual in such apparatus. There can be no doubt as to the welcome extended by central station men to fixtures that do not become grounded or allow leakage in wet weather.

The Elden Circuit Breaker.

It has been the aim and intention of the designers of the Elden circuit breaker to place it on the generator wherever possible, in a position easy of access, although if preferred it can be placed on the switchboard. It has been standardized for all composite type dynamos, whether single-phase, two-phase, three-phase or monocyclic, and is adapted when required to any other such make.

The operation of the breaker on such machines is essentially this. A solenoid in the main circuit operates an armature, which is adjusted for a certain predetermined amount of current in the coil, and which on the increase of current above that amount strikes a pawl which releases a small switch, which opens the exciter circuit of the alternator. This switch in turn, after having opened the field circuits, trips another pawl, which releases the main line switch, thereby opening the main circuit after the field circuit has been entirely killed.


CIRCUIT BREAKER.

In opening, the main line switch does not open the circuit completely, but shunts it into a resistance coil concealed in the back of the breaker, which absorbs the "kick" of the line and protects the insulation of the machine. In addition to this, the main switch in its complete operation performs certain other duties which entirely deprives the machine of all generating ability. With this type of breaker it is impossible to short-circuit the machine externally, even at the collector rings, without opening the breaker, which fact is due to the peculiar method of connection and location. In short, absolute protection is guaranteed, if properly adjusted and connected, against any overload or short circuit that can be applied.

For use on the regular separate excited type of alternator, whether of the inductor or moving armature type, a breaker which is essentially the same as the one just described is used. For two or three-phase or monocyclic generators a special breaker is made to suit each particular case.

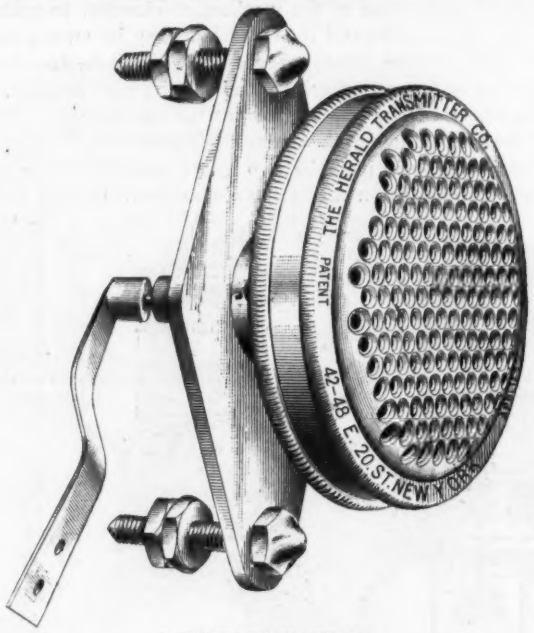
In many installations of the above types of generators, large motor installations exist, which cause large fluctuations in current momentarily, and which would often cause a closely-adjusted breaker to open when it was not necessary. In these cases no standard types can be used, and the application of breaker to conditions as they exist is necessary.

As to the absolutely positive action of the breaker, the reliability and ease of adjustment and the results accomplished by it in actual service, the most conclusive argument is an actual test in use, and to all interested parties such a privilege is offered in their own equipment.

In addition to the above, S. B. Condit, Jr., & Co., of Boston, Mass., offer a feeder circuit breaker, which will open the circuit instantly and in a reliable manner, breaking the arc, no matter how high the voltage. There are many valuable features in the mechanism of this device. It is intended for either alternating or direct current, and is provided with carbon breaks which protect the switch contacts from all damage from the large arcs that are formed by breaking high voltage circuits.

The Herald Telephone Transmitter.

A great deal of electrical engineering ability and invention has been brought to bear, during the past few years in particular, on the improvement of telephone transmitters. The work is still going on, and we may cite as an evidence of this fact the new Herald transmitter herewith illustrated. The standard Herald transmitter, with back support, has the very valuable practical value of being in itself a template for the location of the holes to be drilled in a telephone box, due to the pointed ends of the screws. When the transmitter and back togther are pressed against the wood, the centre indentations are left in the wood. The transmitter may be screwed onto an arm, used with the back contact spring shown, or the wire may be fastened to the back terminal by clamping between the two nuts not visible in the cut. The other connection is made from the frame of the support. It will fit into any Ericsson back, without any preparation. The back contacts are burnished platinum, thus ensuring a perfectly smooth, bright surface. While the absence of a funnel is one of the advantages of this transmitter, it can be made with a funnel front if desired.



HERALD TRANSMITTER.

The design of the transmitter is neat, and the finish—burnished aluminum—attractive and durable. It will not pack or fry, etc., and is hermetically sealed. In fact, it can be submerged for a prolonged period without detriment. Objectionable breath odors and the harboring of disease germs are obviated by reason of the air having perfectly free circulation through the front transmitter.

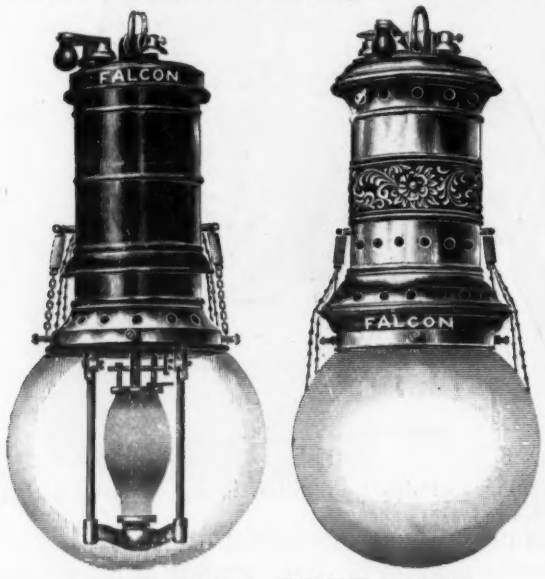
The articulation is excellent, there being an absence of side tones or metallic transmission. The tone of the voice is regular and an exact reproduction of that of the speaker. It can be spoken into closely or a short distance away and the intensity of sound delivered is the same, with absence of shock to the ear drum.

The transmitter is adjusted to work on the desired voltage, each taking a certain small amount of current, and behaving properly while talking, the current fluctuations being confined to certain limits. Once adjusted, it will remain so, and is not affected by changes in temperature. The amount of current used is small, the transmitter being easy to work on the small dry batteries used in isolated exchanges, or for indoor work. It is built to order for any desired back support or voltage. There are four degrees of intensity for each voltage, viz., very loud, loud, medium and soft, designated by A, B, C and D, respectively. The transmitter is especially applicable to centralized battery systems, and the lines can be balanced up by means of the transmitter, those nearest the exchange talking on an equality with those far away, without the use of outside resistance.

This device is being put on the market by the Herald Transmitter Company, which has its headquarters at 42 to 48 East Twentieth Street, New York City.

A New 115-Volt Enclosed Arc Lamp.

The accompanying illustrations show the general appearance of a new arc lamp which has been recently designed. The two styles presented in the cuts are the black, weather-proof lamp for outdoor service, and the brass, ornamental lamp for interior illumination. The new lamp is being manufactured by the Falcon Electric Company, New York, the design and construction being due to H. O. Swoboda, of that company. The most marked claims of superiority for this lamp which are made by the manufacturers include simplicity, long life, and excellent regulation. The mechanism is of the "carbon feed" type, having a clutch, operated by a series coil, which lowers the upper carbon as required. This carbon has only one rigid guide, and therefore will not stick or fail to feed on account of friction against sliding contacts or from improper alignment. The current is led to the upper carbon by a flexible cord, always insuring a perfect connection, the upper end of the carbon being held in a carriage which slides loosely on two vertical rods and is allowed sufficient play to overcome any accidental crookedness in it. The lower carbon is held in a spring grip secured to the brass cap which closes the bottom of the inner globe. This cap is supported by two rods fastened to the base of the mechanism chamber in such a manner that the inner globe and lower carbon may be swung out to the side and thus become readily accessible. An asbestos washer on the lower cap and a gas check, formed by an air chamber, through which the upper carbon passes, prevent the escape of gases from the inner globe or bulb. The outer globe is held tightly in place by two spiral springs which fasten to hooks on the lamp case, and when lowered for trimming it is supported by chains in the ordinary manner.



FIGS. 1 AND 2.—ENCLOSED ARC LAMP.

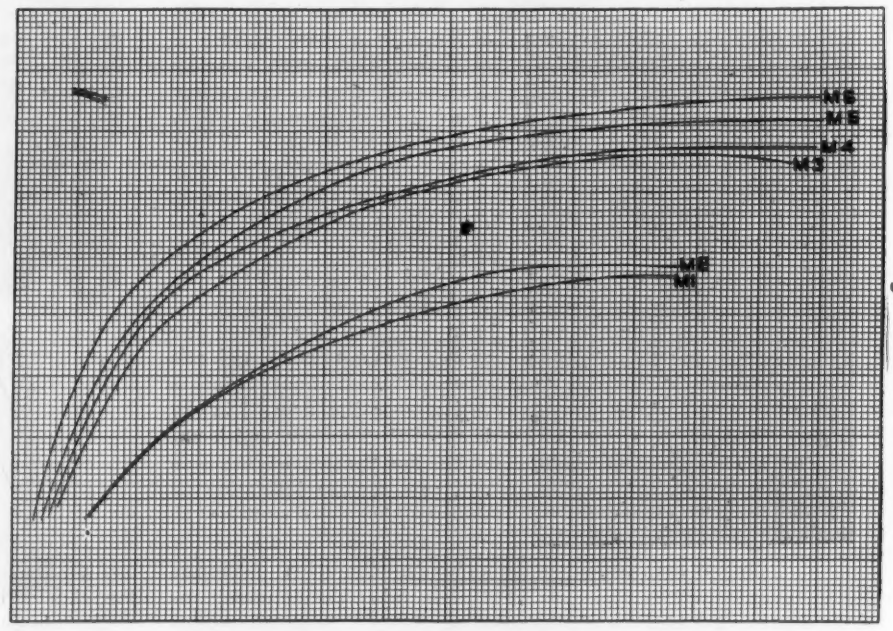
The length of the lamp over all is 22 inches. The carbons used are ½ in. in diameter and 12 ins. and 5 ins. long respectively, and will burn for 180 hours with one trimming. Although a 4-ampere lamp is made, the usual form requires 5-amperes, the regulation being within ¼ ampere each way. The resistance is adjustable through a range sufficiently large to allow the lamp to be used on any pressure from 100 volts to 125 volts. Each lamp is provided with a cut-out switch on the top of the case and effort has been made to make a convenient, serviceable and handsome lamp. The manufacturers state that every precaution has been taken to secure freedom for the users of this new lamp from infringement litigation or other legal annoyance.

Paragon Power Motors.

These motors are made in 18 standard sizes, ranging from 1-20 hp to 1½ hp. In their design the manufacturer—the Paragon Fan and Motor Company, 572 First Avenue, New York—has bestowed as much care as is usually given to larger machines. The type H machine is of comparatively light weight and strictly high grade, both electrically and mechanically. Type L machine is adapted for slow speeds, as in direct-connected work, and type M is recommended for belted service.

FIG. 1.—PARAGON MOTOR.

The ratings are conservative, to carry reasonable overloads and insure cool running. They are taken at a point practically at the crest of the efficiency curve, and the shape of this curve is such that it is approximately straight at this point (see Fig. 2), so that 15 per cent underload or overload can be carried at practically the same efficiency as full load. The figure shows the efficiency curves of the size M 1, 2, 3, 4, 5 and 6 machines respectively.



FIGS. 2.—PARAGON MOTOR EFFICIENCY CURVES.

The Paragon motors commutate 75 per cent overload without distructive sparking, and 25 per cent overload without perceptible

indication at the brushes. Special care is bestowed upon the commutators in their upbuilding.

In the smaller sizes, square pencil brushes are used, while on the larger sizes the new Paragon "inclined plane" brush holder carries a triangular brush which is held firmly between an inclined surface and a pressure finger.

A particular feature of the Paragon motors is the field frame, which, by reason of its form, is free from magnetic joints. By removing two nuts the entire front of the machine may be removed, thus giving easy access to the interior, for inspection or repairs. Ample self-aligning and self-lubricating bearings are provided; and, owing to the enclosure of the commutator end and to the protection afforded by the pulley, these are rendered practically dust-proof.

The field coils are form wound, and after taping with two layers of linen are dipped in insulating varnish of such penetration that the covering of each individual turn becomes saturated; after which they are thoroughly baked. The armatures are hand-wound by expert winders, the turns being laid in overhanging slots and thoroughly insulated with mica and heavy paper, and after dipping are baked similarly to the field coils, the shape of the teeth rendering binding-wires unnecessary.

By the use of universal bearings which may be readily turned to operate in any position, and by means of suitable slide-rails, the Paragon motors may be suspended from either side-walls or ceiling, Fig. 1, being a view of a motor attached to the ceiling.

Automobiles and Parts.

The St. Louis Automobile & Supply Company started about a year ago in the industry, and has now developed a considerable business not only in the manufacture and sale of automobiles, but in furnishing the many parts essential to the operation of the machines. Figs. 1, 2, 3 and 4 herewith illustrate some of its types of vehicles, both electric and gasoline. Fig. 1 shows its electric runabout being operated by Mr. A. L. Dyke, the electrical and mechanical expert of the company, who has been working for years in this field.

It is equipped with a 2½-hp electric motor of the enclosed type, 40 cells of Willard batteries, wheels 28″ x 3″ front and 34″ x 3″ rear. The gear is enclosed in an aluminum cover and the gears run in oil. The running gear is flexible and allows the vehicle to run over obstructions without any undue strain on any part of the vehicle.

FIG. 1.

FIG. 2.

FIG. 3.

Fig. 2 shows several vehicles which are manufactured by the above company, with the exception of the one in front, a motor-cycle. This machine the company acts as agent for. The second machine in the line shows the electric runabout just described; the third is one of its gasoline runabouts; the fourth, an electric Stanhope, and the fifth a gasoline trap. Fig. 3 shows a very elegant delivery wagon made with either electricity or hydro-carbon motor as motive power. Fig. 4 shows a complete running gear, equipped with the company's improved double-cylinder gasoline engine, transmission, etc., all ready for the body. The object is to supply the trade or individuals with this running gear complete, ready to mount the body, paint and upholster.

A 30-page catalogue has just been issued, and parties contemplating the construction of, or buying a complete vehicle, are invited to correspond with the company.

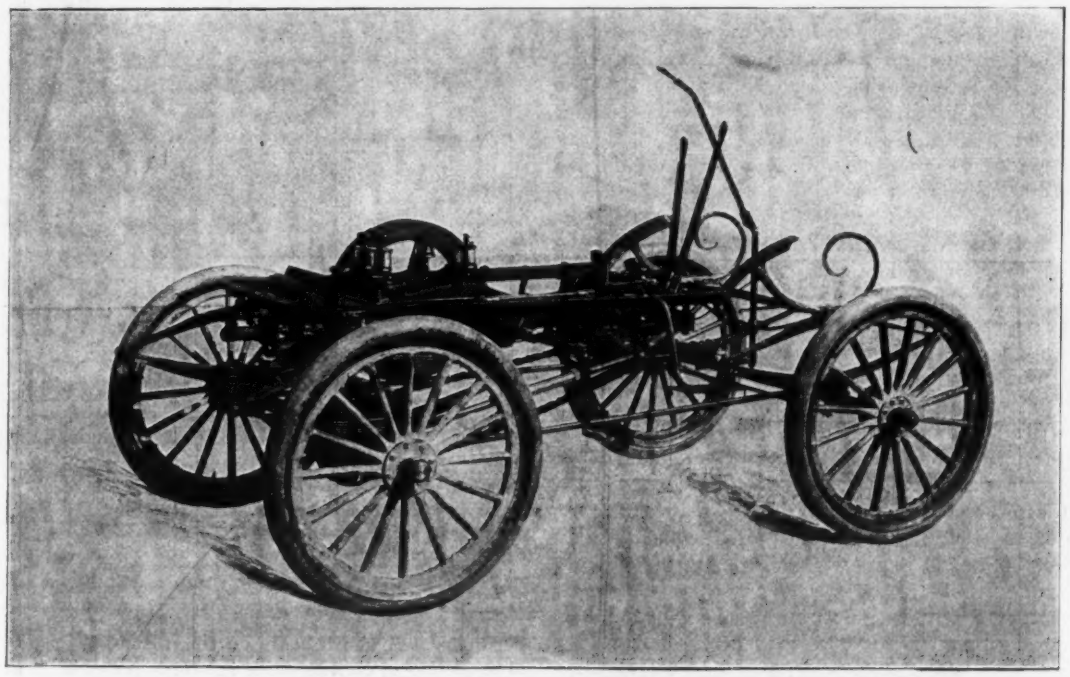


FIG. 4.

Carleton Electric Locks.

Numerous attempts have been made to operate locks electrically, and one general cause of failure has been the weakness of the current available from primary batteries adapted to household use. The work of withdrawing the bolt devolved upon the armature and the law of inverse squares came into play with disastrous effect. A magnet small enough to go in a mortised lock coupled with the household battery of a few Leclanche cells was usually ineffective. The electrical door openers ordinarily used in flat houses are inserted in the jamb of the door, thus permitting the use of larger magnets, and the armature is attached to a sort of trigger detent which, when released, allows a cylinder to revolve. Upon this cylinder is a

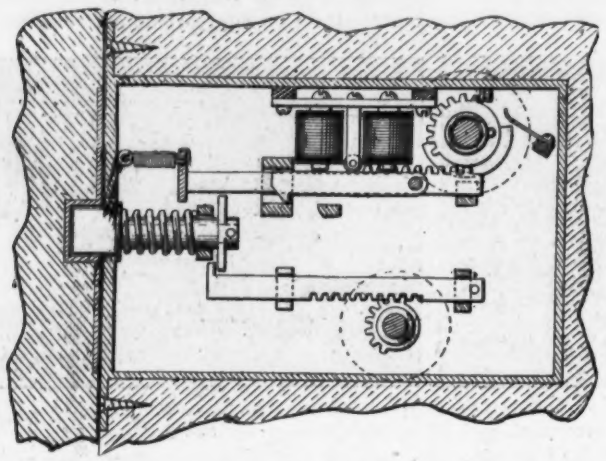


FIG. I.

stud normally engaging the latch in the door and preventing it from being opened.

Mr. Henry Guy Carleton has invented a system of locks, operating on a new principle, which contains many unique features. In the Carleton locks the armature is not called upon to withdraw the bolt or to hold a detent in locking position, or to do any considerable amount of work. Several forms of locks have been devised, and a few are illustrated in this article. In one form its use is limited to keeping a small but strong controller from dropping down and locking the mechanism. This it is enabled to do with a minimum of current, as the controller is lifted mechanically into actual contact with the poles of the magnet. In this form it will be seen that if an attempt be made to operate the bolt by turning the knob-spindle the controller will drop and check the operation by engaging the lug in the lock case unless current is passing through the coils. If, however, the magnet is energized, the controller is held up by it and the mechanism is allowed to operate without hindrance (Fig. 1).

Another opener employing magnetic traction at its fullest efficiency, and permitting as much movement of the bolt as may be desired, is shown in Fig. 2. Here the magnet is attached to a frame sliding in ways and normally kept in contact with the armature by spring pressure. If the knob-spindle is turned, the cam will retract the frame which carries the magnet. If there is no current passing through the coils, the magnet will leave the armature and the lock cannot be operated. On the other hand, if the circuit is closed the magnet will grip the armature to the full extent of its efficiency, taking it back, and the bolt with it, when the knob is turned.

The same result is obtained by a gravity controlled armature. In this form a long, slender armature lies in contact with the poles of the magnet and a hook on its end is in position to engage a collar on the bolt. If the knob is turned, and there is current passing through the coils, the magnet holds the armature till the hook engages the collar on the bolt. After this the pressure of the collar against the hook, caused by the resistance of the bolt's spring, will prevent the armature from dropping, even though the current be then broken for purposes of economy in the battery. If there be no current in the circuit the armature will drop out of the engaging position and will not operate the bolt. The magnet employed in this form weighs less than one ounce, and since the depth of the lock is but three-fourths of an inch it can be placed in the thinnest doors.

By employing an iron-clad magnet, the lock will operate on a current of 1-50 of an ampere and a pressure of 2 volts. A similar lock on the same principle has a mechanical device operating so as to dead-lock the bolt when the door is closed, and leave it free to retract while it is being closed.

In addition to compactness and simplicity of mechanical construction, these locks have the advantage of working with less than a quarter of the current required to operate an ordinary house bell. The circuit closers in the locks are also arranged so as to break the circuit the moment the bolt-withdrawing mechanism is put into operation, at which moment mechanical resistance holds up the armature and the current is unnecessary. By this means an additional means of economy of current is secured.

The form of lock illustrated in Fig. 3 is designed for use in windows, sliding doors, showcases, tills, etc. As shown, it consists of a hook-shaped armature acting, when not retained by the magnet, so as to thrust the hooked end through a slot in the casing and engage with a recess in the window frame or sliding door, thus preventing its further motion. If an attempt is made to open it, the hook merely slides till its end comes against the side, when its further motion is impossible. At the same time a stud on the other end makes a sliding contact with a terminal attached to the insulating block, and diverts the current to the alarm bell, giving warning that an attempt is being made to force the lock. When the window is closed, the striking plate, which protects the edges of the recess in the window frame, acts on the cam face of the hook-end of the armature in such a way as to throw it back against the poles of the magnet. If now a current be passed through the coils the magnet will hold the hook in a retracted position and the window may be raised to any desired point. The current then being broken, the spring is ready to throw the hook into locking position the moment an attempt is made to raise the window. By this means a window may be left open a few inches either at top or bottom, and yet be securely locked. It may be closed without the application of current, but cannot be opened unless the button is pressed.

An additional invention of Mr. Carleton's is a combination lock which is operated by the sense of touch and requires no numbered dial in setting the combination (Fig. 4). Electrically, it consists of two discs fastened to the same spindle. One disc is of insulating material, through a portion of which passes a conductor. Two brushes are so placed as to be simultaneously in contact with the ends of this conductor when the disc is in a predetermined position.

The other disc is of metal, with a small insulated section in the

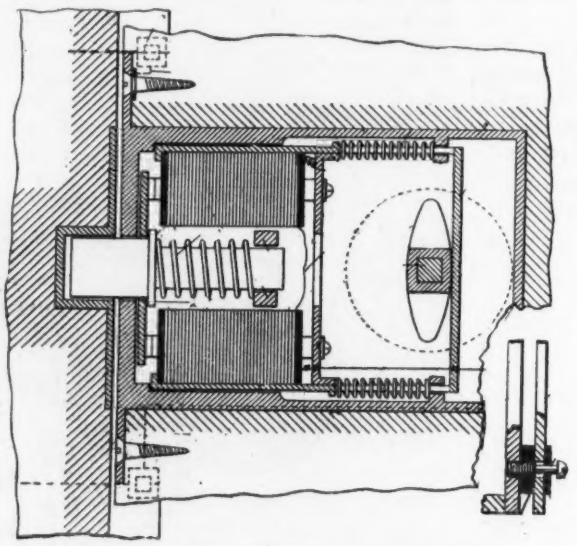


FIG. 2.

periphery. A brush bears on this disc and, in all positions save one, is in electrical contact with it. This position is when the other disc affords electrical connection between the two other brushes. To determine the position of these discs with respect to the brushes, the following simple expedient is employed. A disc is provided with 10 notches within the space of two-thirds of the circumference; the other third is left smooth. A spring presses against this disc, and as the spindle is rotated the notches can be felt and counted. To find a definite number, therefore, it is only necessary to turn the disc in either direction till the smooth surface is felt; then the position may be determined by rotating the spindle till the required number of nicks have been passed. At this position the brushes on the insulating disc are in position to transmit current to either one lock,

or a number of locks. An alarm circuit is provided for in these locks. When the combination is set so that the lock may be opened, the brush attached to the alarm circuit is resting on the insulated portion of the metal disc. In this position the operating current will pass, but the alarm current is broken. In any other position the alarm circuit is operative and the lock circuit inoperative. By combining two sets of discs with the brushes in series, the chances of a thief finding the right combination are one in one hundred. If he guesses wrongly, he sounds an alarm on attempting to operate the lock. By using three in series the combination is one in one thousand. A simple arrangement allows the combination to be changed in a moment.

To prevent anyone from unscrewing the plate covering the combination and seeing what it is, as also to prevent any portion of the lock from being drilled, or the lock itself from being removed from the door or tampered with, the device which is shown in the lower corner of Fig. 2 is employed.

This consists of an insulated plate on the outside of the door, covering the entire lock, which is in connection with the alarm circuit. Between this and a similar plate beneath, is a thin sheet of insulation. The screws connecting these plates and fastening them to the door are turned down near the head so that when the screw is home its head will rest against an insulating washer, and the thin portion of the body is not in contact with the outside plate, but is in contact with the inner. If an attempt be made to withdraw the screw, its thick portion must necessarily come against the outer plate and establish connection between the two, instantly sounding an alarm, as each screw gives an alarm. To remove a plate, six alarms, each of considerable duration, will be sounded by the thief. Any attempt to drill the lock will, of course, instantly connect the inner and outer plate and sound an alarm. To prevent the end of the screws being cut off by pliers the

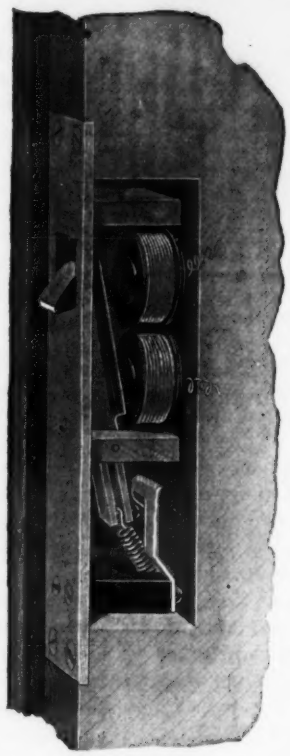


FIG. 3.

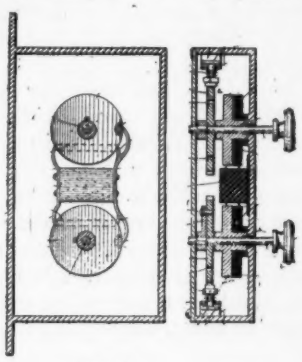


FIG. 4.

heads are countersunk. This method of preventing the locks being tampered with is, of course, applicable to all.

A style of lock is also being made in which an attempt to open by an improper key will sound an alarm. These locks are further designed to prevent their operation by the proper key except when so permitted by a distant controller.

By the use of these circuit controlled locks, it can be seen that all the locks in a building, or any portion of them, may be under such control that after certain hours even those persons who have the proper key will be unable to get access to whatever the lock protects. When the combination is correctly set an improper key will sound an alarm, an attempt to drill or unscrew the lock will sound an alarm, and the proper key will open the lock noiselessly. On the other hand, if the combination is off, an improper key will sound an alarm, an attempt to unscrew or drill the lock will sound an alarm, and even the proper key will sound an alarm and be unable to operate the lock.

A still further invention in this connection is a time circuit controller, capable of operating a number of lock circuits at variable hours. It also provides for one, two or three holidays. An ingenious feature in this contrivance is that no spark can possibly occur between the contacts of the clock-operated controller.

The patents on these locks and controllers taken out in this country and abroad have been assigned to the Carleton Electric Company, of New York, which is now manufacturing the devices for the market.

Storage Battery Equipment in a Silk Mill.

An example of the peculiar advantage possessed by the storage battery in affording means of increasing current supply with practically

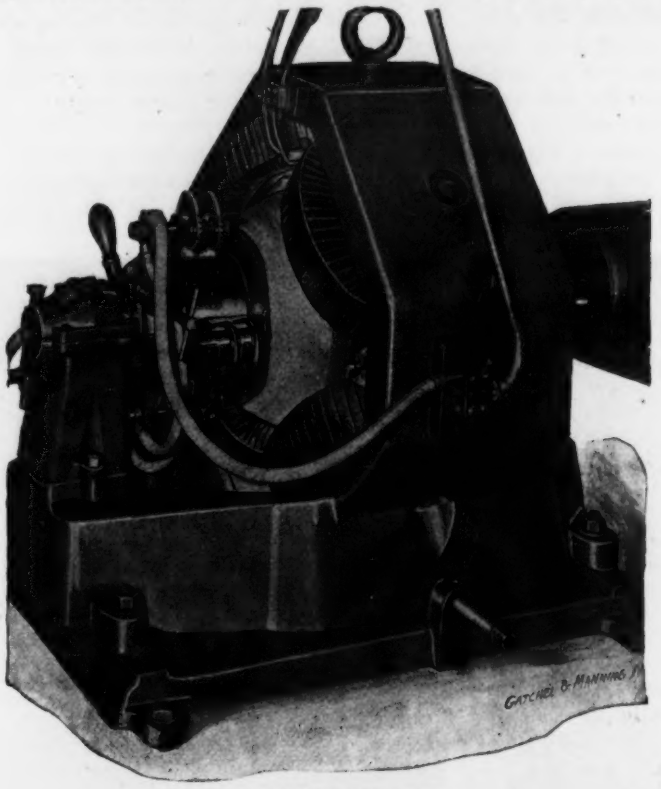


FIG. 1.—THE BOOSTER.

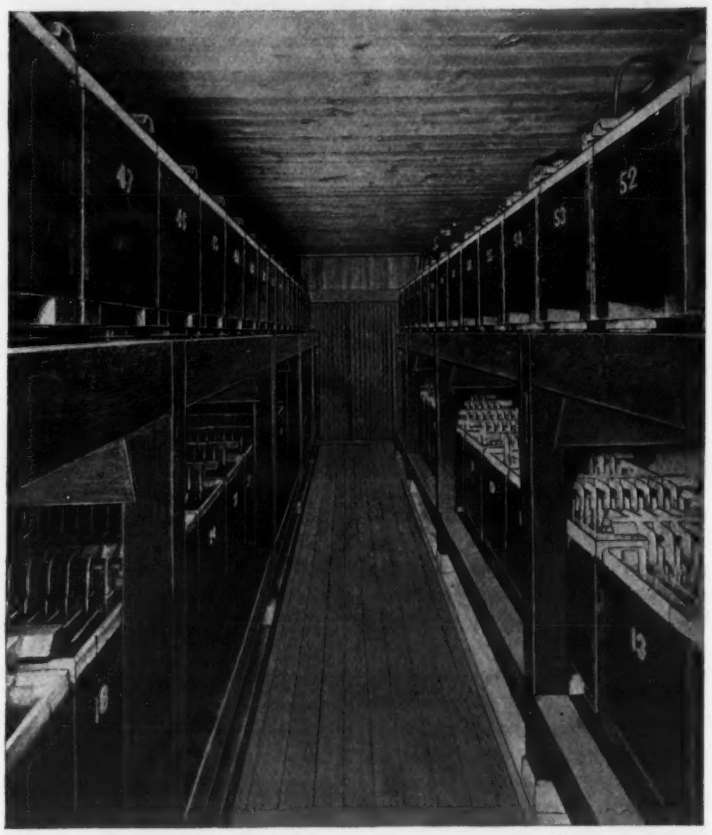


FIG. 2.—BATTERY ROOM.

little increase in plant is found in the battery equipment at the silk mills of the R. & H. Simon Company, at Union Hill, N. J. Large additions were made to the mill buildings, but a difficulty presented

itself when it came to making provision for the extra light and power necessary for the new additions. The steam plant was already loaded well up to its limit during the early morning and late afternoon, and the engine room afforded no available space for the installation of additional units. The installation of more steam apparatus, even if sufficient room were available, would require the firing of an extra boiler twice a day for one or two hours in the morning and in the afternoon when the maximum loads occurred. It was finally decided to install a storage battery plant, which would not only obviate these difficulties, but at the same time add advantages to the existing electric and power equipment. With the battery the surplus energy at the hours of light load is stored and used to assist the generators when the peak loads come on. By this method a large saving in fuel is effected.

Another important advantage afforded by the battery installation is the provision of electric service at any time during the 24 hours. In this particular instance, on account of the proposed installation of

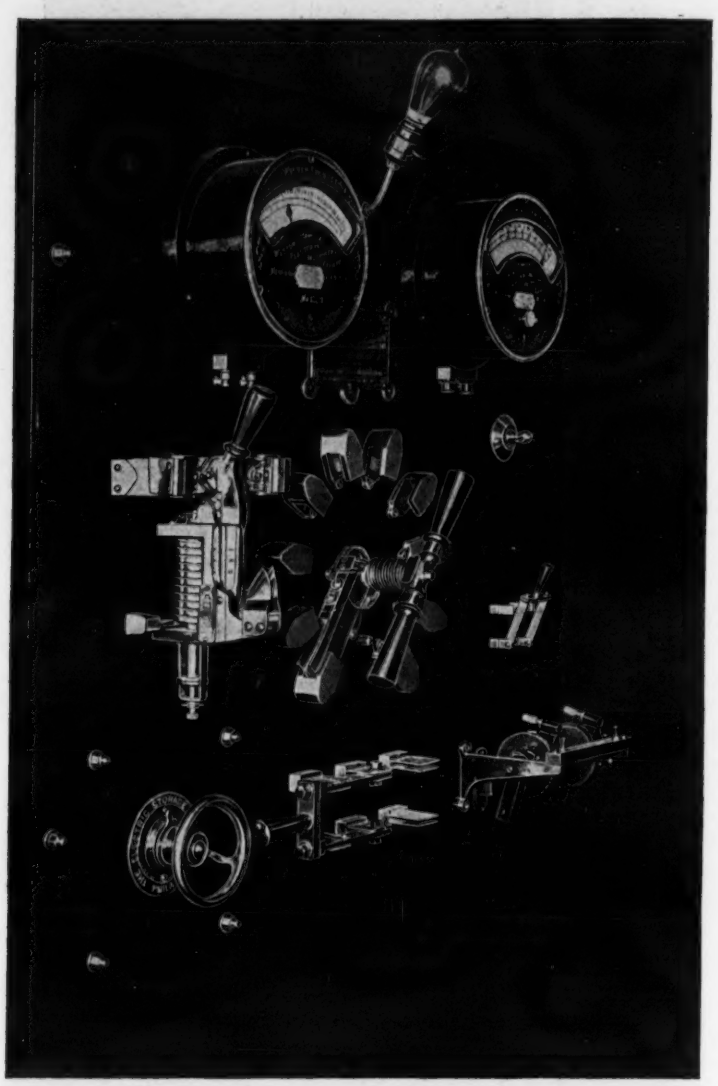


FIG. 3.—BATTERY SWITCHBOARD.

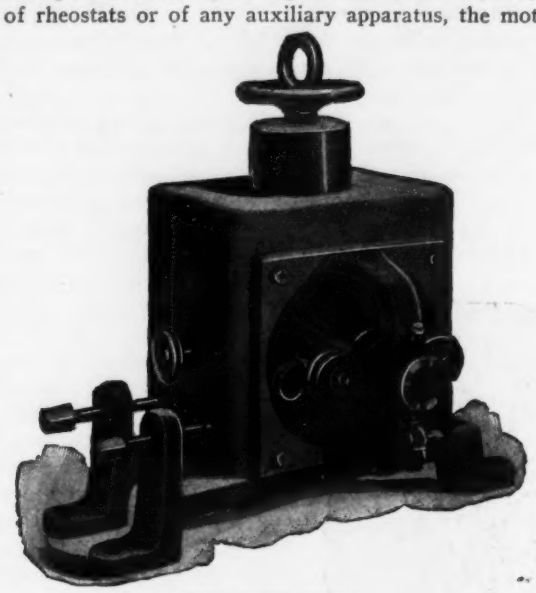
motors throughout the mill to supplant the shafting, it will be possible to run a machine here or there after working hours without the necessity of running the engines or wasting energy in driving shafting. The steam plant can be shut down at the usual time, and yet power and light are available.

This battery plant is modern in every particular. It consists of 64 cells of 640 amp.-hours capacity, the voltage being 110. Each cell contains 17 plates, 10½ ins. square, suspended in lead-lined wooden tanks having outside dimensions of 21¾ ins. width, 15 ins. length, 17¾ ins. height. These cells are mounted upon two parallel wooden racks, each rack supporting two tiers of 16 cells each. The battery occupies a room by itself next to the engine room, and by means of a 00 cable it is connected to the battery switchboard and to the small belt-driven booster, shown in one of the illustrations. This plant was installed by the Electric Storage Battery Company, Philadelphia, Pa., the cells, of course, being of the chloride type.

Multi-Speed Motors.

Very many mechanical operations require that the speed of the machine operated can be varied according to the requirements of the work to be done, or the tools being used. Hitherto this has been accomplished, in a more or less perfect manner, by the use of auxiliary apparatus, rheostats, etc., the system being usually more or less complex and wasteful of current, and the results obtained not nearly as satisfactory as desired, but the best obtainable under the existing state of the art.

It has long been desired that some means should be found whereby absolute and perfect motor speed regulation can be obtained, without the use of rheostats or of any auxiliary apparatus, the motor itself



MULTI-SPEED MOTOR.

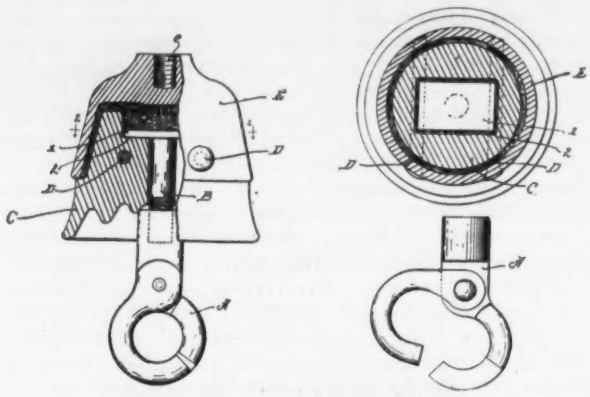
being all the mechanism used, and containing in itself all the conditions necessary to accomplish the desired results in a simple and economical manner. The Stow multi-speed motor is confidently offered as a complete and perfect solution of this problem. This motor, without the use of any rheostats or auxiliary apparatus, and without any special or complicated system of winding, or any shifting of the brushes, gives any speed required between its maximum and minimum limits, by simply turning the small hand-wheel on the top of the motor; no current is lost in any rheostat or other apparatus, there is no sparking at the brushes at any speed or load, its efficiency is high, its construction simple, its economy great and its cost comparable with any other first-class motor now on the market. The many applications are obvious, and E. R. Knowles, 136 Liberty Street, New York, a well-known electrical engineer, is now making a special study of them in behalf of the Stow Company.

Insulated Hanger for Arc Lamps.

A new form of arc lamp hanger is shown in the accompanying illustrations as designed by Mr. George Cutter, of Chicago, for the company bearing his name. The lamp is supported by a hook *A*, made in the form of a ring split longitudinally in two sections, one of which is pivoted to the upper part of the hook, Fig. 2. The lamp is engaged by swinging the pivoted section upwardly, and passing the fixed portion of the ring through the eye in the lamp and then closing the pivoted ring-section downward and into position, as shown in Fig. 1. The hook *A* is supported by a bolt *B*, to which the hook is threaded. The bolt *B* is in turn supported by an insulator *C*, the bolt being provided with a head 1 and the insulator with a flat supporting portion 2, upon which the head 1 can rest. The hole in the insulator *C*, through which the bolt *B* passes, is made a little larger than the bolt, to prevent cracking and binding. The supporting-surface 2 of the insulator is depressed below the top so as to form a recess or socket for the head 1 of the bolt *B*. The socket is made to correspond with the shape of the head 1, so as to prevent the latter from turning, and thereby allow the lamp-holding hook or ring *A* to be readily screwed on or off from the bolt.

The insulator *C* is supported by a couple of pins *D D*, extended transversely through it, as shown in Figs. 1 and 2. These pins are separated from one another by a distance less than the head 1 on the bolt *B*, as shown in the figures. In this way the head of the bolt

B will catch and rest upon the pins *D D* should the insulator *C* become broken, so as to allow it to fall. The pins *D D* are in turn supported by a hood *E*, which is adapted to cover and partially enclose the insulator. The pins *D D* are extended through the walls of the hood *E*, as shown in Fig. 2, so that they can be inserted into and withdrawn from position from the exterior of the hood. The hood



FIGS. 1 AND 2.—INSULATED HANGER.

E is generally made of metal, and cast into form. The socket above the bolt-head 1 is filled with insulating material, such as wax, as is also the space between the hood and insulator. The upper end of the hood *E* is provided, in one arrangement, with a threaded socket *e*, into which the threaded end of a hook or ring can be secured to support the hanger.

The hanger is put together by inserting the bolt *B* into the insulator *C* and then securing the hook or ring *A* to the projecting end of the bolt. The hood is then placed in an inverted position and a quantity of wax or the like sufficient to fill the socket and other space is poured into the hood. The insulator is then placed within the hood, and the pins *D D* are inserted in the holes in the hood and insulator and fastened at their ends, which project through the hood.

The hook *A* can be readily attached and detached from the bolt *B*. When the lamp is in position, it is thoroughly insulated by the insulator of the hanger, so as to prevent bad results from contact or connection with the lamp. Should the insulator become broken, it will be impossible for the lamp to fall, because the head of the bolt *B* will engage the pins *D D*. The hanger is held securely together without any possibility of coming apart by pins *D D*. If necessary these pins can be withdrawn from the outside, the insulator *C* taken out and the bolt *B* removed from the interior.

American Stone Conduit.

The electrical conduit problem has received much attention in the past decade from inventors, electrical companies and public authorities, and many meritorious systems have been developed as a result. One of the latest of these to bid for favor is that of the American Stone Conduit Company, West Eighteenth and South Lincoln Streets, Chicago, Ill., of whose material and method two illustrations are given herewith. The ducts are made of a mixture of crushed stone

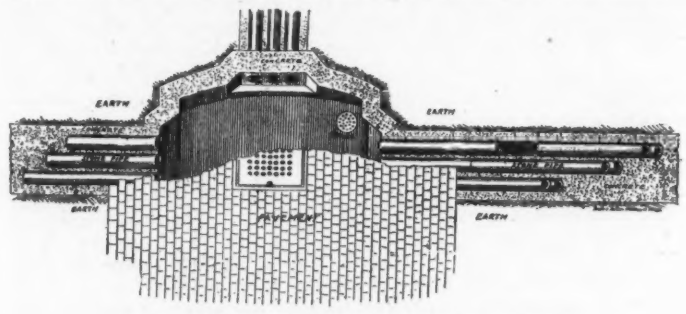


FIG. 1.—TOP VIEW OF MANHOLE AND CONDUIT.

and Portland cement, which makes a structure that is said to be electroylsis, acid, water and gas proof, and practically indestructible. In their manufacture they are subjected to an internal pressure of 2500 lbs. to the square inch, which process gives the interior of the pipe a polished finish, with an unvarying diameter, and a resulting uniform strength and density. The ducts are cured by water, no kiln-drying or burning being employed to attain this result; and the older the pipe and the longer its exposure, the harder and stronger it becomes.

These pipes are made in lengths of 6 feet, and they can be easily sawed to shorter lengths or to any angle. When they are laid in place the cement unites with the exterior of the ducts so tenaciously as to form a solid structure of stone of great resistance to mechanical strains from without. Perfect alignment of adjoining pipes is secured by using the company's rubber mandrel in laying the ducts in concrete.

The machines used in the manufacture of these ducts are con-

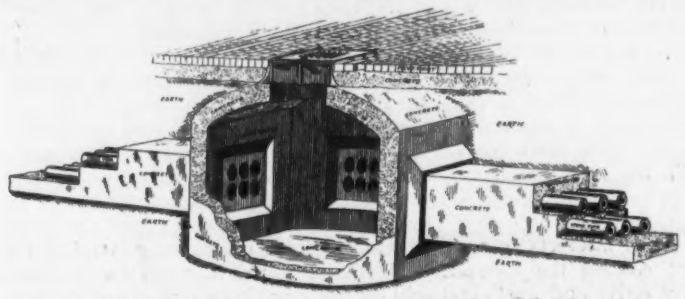


FIG. 2.—SIDE SECTION OF MANHOLE AND CONDUIT.

structed of steel, to withstand the immense strains to which they are subjected, and they turn out one pipe every 40 seconds each. An important advantage offered by this system is that the construction of a subway may be accomplished very rapidly, using only ordinary labor in the entire work.

Automatic Resistance-Reducing Device for Motors.

Following up his previous work in this field, Mr. G. H. Whittingham, of Baltimore, has taken out a patent on an automatic starting device for electric motors of that class wherein a resistance in the circuit of the motor is gradually reduced by cutting out the coils of resistance one after the other from that of the greatest resistance to that of the least resistance. A previous patent in 1893 covered a mechanism comprising a compound solenoid-magnet wherein a coarse wire low resistance is used when starting the motor and a fine-wire high resistance while the motor is in operation. In the present invention a low-resistance heavy current is also first used and then a high-resistance small current; but the method of employing these currents is radically different from that disclosed in the earlier patent, in which there is a rigid connection between the movable resistance-controlling shoe and the armature of the solenoid-magnet. In the present invention the heavy current passes through the coil

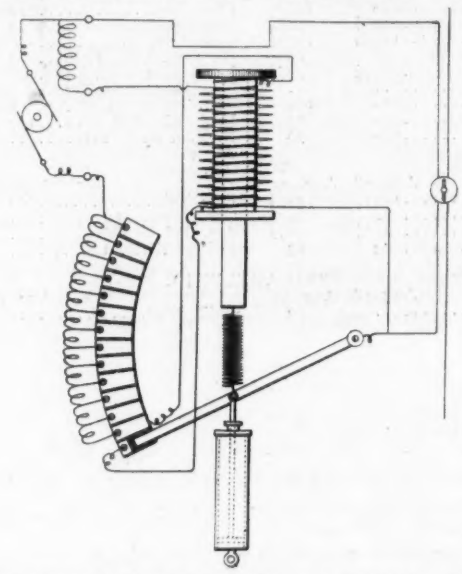


DIAGRAM OF CIRCUITS OF RESISTANCE REDUCING DEVICE.

around the magnet only for the very brief period that is required to raise the weight whereby the power is stored which subsequently operates the resistance-cutting-out device. This cutting-out device is then operated by such stored power without any further current passing through the coils of the magnet, which affords advantages that are obvious. The device and circuit are shown in the accompanying illustration.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—The quiet of the money market was maintained last week, loans being exceedingly dull. Call money is plentiful at 1½ per cent. Time money is dull, the rates being 3½ per cent for short and 4@4½ per cent for three to six months. Commercial paper is in better demand, and a fair supply of acceptable names is reported, the rates being 4@4½ per cent for double names. The stock market during the past week was pronouncedly dull, the total transactions at the New York Exchange on several days falling to below 100,000 shares, which is regarded as only an average day's business. The public is doing nothing, and the large financial interests seem to be waiting for a revival of general activity. Among the specialties, Brooklyn Rapid Transit was particularly active and weak, and sold off presumably as a result of the preliminary report, a summary of which was given in these columns last week. This stock closed with a net loss of 4 points, the sales being 81,775 shares. The highest point reached was 57½ and the lowest 53¼, at which price it closed. Metropolitan Street Railway closed at 153⅜, a net loss of 2 points, the sales being 1765 shares. Western Union also suffered a net loss of ¾ of a point, closing at 79⅜, the total sales being 4343 shares. General Electric was the only exception in the electrical list, and closed with a net gain of 2 points, the closing quotation being 138. Early in the week this stock sharply advanced to 140¾ on extremely light trading. Specialists were the buyers, and their orders were said to come from insiders. Talk of steadily increasing business and a plan to extend the company's trade in Japan received some confirmation, but the revived story of a union with the Westinghouse Company was not credited. The company's debenture bonds, which are convertible into stock at the rate of $120 in bonds for $100 stock, were also in good demand. The market for outside securities was listless. Only a few stocks figured conspicuously in the transactions, and dealing in the other issues was restricted to extremely small sales, many stocks ordinarily traded in under usual conditions being neglected altogether. The copper stocks were steady and fairly strong, with light transactions and fractional fluctuations. The transportation stocks were practically inactive. Electro-Pneumatic and General Carriage were active at times. Following is a list of the closing prices at New York, Boston and Philadelphia, with the closing quotations of the week previous for comparison:

NEW YORK.

	Aug. 18.	Aug. 25.		Aug. 18.	Aug. 25.
Gen. Elec.	136	138	Elec. Veh.	16½	16
Bklyn. Rap. Tran.	57¼	53¼	Elec. Veh., pfd.	40	40
Met. St. Ry.	154½	153⅜	Gen. Car.	6⅜	6⅜
Am. Tel. & C.	..	89	Ill. Elec. Veh. Tran.	1⅜	1⅜
West. Un. Tel.	80⅛	79⅜	N. Y. Elec. Veh. Tran.	8	7½
Am. Dist. Tel.	..	..	New Eng. Elec. Tran.	3¼	3¾
Com. Cable.	160	164	Tel., Tel. & Co. of Am.	6¼	..
Elec. Boat.	13	13	Hud. Riv. Tel.	117	..
Elec. Boat, pfd.	30	30	N. Y. & N. J. Tel.	..	..

BOSTON.

	Aug. 18.	Aug. 25.		Aug. 18.	Aug. 25.
New Eng. Tel.	123½	123½	Erie Tel.	96	96
Mex. Tel.	2	..	Gen. Elec., pfd.	..	139
Westingh. Elec.	45½	46⅛	Am. Tel. & Teleg.	..	..
Westingh. Elec., pfd.	63	65	Edison Elect. Lt.	..	..

PHILADELPHIA.

	Aug. 18.	Aug. 25.		Aug. 18.	Aug. 25.
Elec. Stor. Bat.	..	72	Phil. Elec.	..	2⅜
Elec. Stor. Bat., pfd.	..	90	Pa. Elec. Veh.	..	..
Elec. Co. of Am.	..	..	Pa. Elec. Veh., pfd.	..	..
Gen. Elec. Auto.	..	¼	Am. Rys.	..	32

MORTGAGES.—The York Traction Company has executed a mortgage for $1,500,000 to secure an issue of bonds. The mortgage is in favor of the Real Estate Trust Company, Philadelphia, Pa. The New York, Westchester and Connecticut Traction Company has filed a general mortgage for $2,500,000 in favor of the Hamilton Trust Company. The mortgage is given to secure an issue of 4 per cent. 50-year gold bonds.

DULUTH STREET RAILWAYS.—The receivership of the Duluth Street Railway Company has been terminated by order of the District Court and the receiver discharged. The company gave a trust deed to the Central Trust Company of New York covering first mortgage 5 per cent bonds to the amount of $2,500,000, which are to be used to take up the outstanding indebtedness and extend the lines of the company.

BELL TELEPHONE.—An official of the American Telephone & Telegraph Company gives out correct figures regarding the capitalization and bonded debt of the American Telephone & Telegraph Company (long distance), from which it may be inferred that the $32,000,000 long distance stock in the American Bell Company's treasury will be divided among the Bell shareholders, making the third share, as was expected in the change of Bell stock for long distance, or the entire amount of stock will be returned to the long distance company's treasury. The situation is practically as follows: The total American Telephone & Telegraph Company capital issued and subscribed for is distributed as follows:

American Bell stockholders	$52,000,000
In the Bell treasury representing original investment of Bell in long distance company	32,000,000
Aug. 15 payment of subscription	5,000,000
Payment Jan. 15	5,000,000
Total	$94,000,000

It is the $32,000,000 represented by the original investment in the long distance company by the Bell that will be divided or returned to the long distance treasury. If returned to the long distance treasury

Bonds issued	$6,000,000
Sold recently	4,000,000
Option given on	5,000,000
Total	$15,000,000

All bonds are 4 per cent, secured by collateral.

CONSOLIDATING NEW ORLEANS RAILWAYS.—The report comes from New Orleans that the scheme of consolidating the street railroads of that city will be carried out in the fall. In consequence of this there has been an advance in both the common and preferred stocks of the New Orleans City Railway, though the net earnings fell off $15,000 during July.

ATLANTA, GA.—The Atlanta Railway & Power Company has filed a mortgage of $6,000,000 covering its property. It is a consummation of a plan to consolidate the street railway interests of Atlanta.

BOSTON.—Messrs. Kidder, Peabody & Co. have been awarded by the West End Street Railway Company $2,112,000 4 per cent 15-year bonds at 104.69.

Commercial Intelligence.

THE WEEK IN TRADE.—The trade conditions last week were so unlike with respect to sections that it is difficult to describe the actual situation. Bradstreet's, however, states that the conflicting currents conspire to bring about a sort of balance which well accords with the weather conditions and the particular season of the year. In the iron and steel trade improved tone and larger buying are reported, and the demand last week for the cruder forms, particularly pig metal, was better. Some reaction from late low prices of bars and sheets is reported, and Pittsburg quotations of bars are 1.10c, with 1.25c predicted. Some benefit from the late reduction in structural material has been noted in the shape of orders, though this business is naturally slow to develop. Steel rails hold the old nominal quotation of $35, despite some rumors of lower rates. There is a better business doing in hardware at several markets West and East, though it is claimed in some instances at the expense of prices. Tin is lower, in sympathy with a speculative break at London, while copper and lead are quoted steady at old quotations, which, for copper, are 16⅝c for lake and 16½c for electrolytic and casting metal. The gross railway earnings of 60 roads for the second week of August aggregate $8,997,777, a gain of 8.6 per cent over a year ago. Bradstreet's reports 135 failures in the United States during the week, against 168 for the previous week, and 154, 172, 210 and 320 for the corresponding weeks of 1889 to 1896. The Middle States had 44, New England 25, Southern 13, Western 36, Northwestern 9, Pacific 6, and Territories 2. Canada had 29, against 24 for the preceding week. About 86 per cent of the total number of concerns failing had capital of $5,000 or less, and 11 per cent had from $5,000 to $20,000 capital.

ELECTRIC ELEVATORS.—One of the most important developments that has taken place for some time past in the industrial field of heavy electrical engineering is signalized by the formation this week of the Marine Engine & Machine Company under the laws of New Jersey. This concern has a nominal stock of $500,000, but there is understood to be unlimited capital behind it, while the men interested have long been prominent in the electrical field. The president is Mr. M. F. Moore, a well-known shipbuilder, machine constructor, etc., whose name is very familiar among Edison central station men.

He will also be shop manager. The vice-president is Mr. F. S. Hastings, and the treasurer is Mr. A. S. Beves, both of whom were at one time leading officials in the Edison General Electric Company, and have since been identified with leading Wall Street interests. Mr. Hastings is a family connection of Mr. E. C. Benedict. The general sales agent is Mr. C. A. Benton, of Edison and Sprague fame, who was until recently the representative of the Sprague Elevator Company. Offices have been taken at 80 Broadway, and the concern already owns a perfectly equipped machine shop at Harrison, N. J., 500 ft. long by 200 ft. wide, modern in all its tools, etc. Details as to the plans of this important new enterprise cannot yet be fully elicited, but it is understood that it holds some of the latest patents on controllers and a new and improved safety invented by Mr. C. R. Pratt, who was associated with Mr. F. J. Sprague in his elevator work. The officers state that the concern intends to beat all records in the way of pushing electric elevators, as it believes the time is ripe and that central station operators all over the country are demanding an economical, inexpensive form for their customers and circuits and as an outlet for current. They will make a modern worm-gear drum elevator adapted to the latest requirements.

WESTERN ELECTRIC FACTORIES.—The Western Electric Company has purchased extensive dock property at the river and West Polk street, Chicago, at a price which represents, for land and some minor improvements, $617,500. Allowing $50,000 for the building and personal property acquired, the land purchase will represent an outlay of $567,500. The tract of land includes about 225,000 square feet. Ultimately the whole site is to be improved with a large manufacturing building devoted to heavy foundry and factory work, and particularly to the construction of cables used in electrical work. For heavy factory work the site is ideal. It has river frontage and the best of railroad facilities. The large West Side plant of the company has no railroad connections. If the recent building development of the company is taken as a guide to future extensions, it is safe to predict an ultimate expenditure of over a million dollars on the Polk Street lot. The railroad and river frontages are about 400 feet each. The land is only improved to the extent of some one-story buildings. These are to be remodeled at once for the occupancy of the Western Electric Company, and will be used in the manufacture of cables, a department now carried on at the main plant on the West Side. S. A. Treat & Co. are making the plans for remodeling the existing buildings. This improvement is in a sense of a temporary character.

TOOLS AND MACHINERY.—Exports of American tools and machinery do not show the shrinkage in volume which recent reports would indicate. Some concern has been expressed by leading export houses by reason of a falling off in foreign orders due to the high prices of iron and steel. In this connection it will be interesting to note that the exports of builders' hardware, saws and tools during the fiscal year 1900 were the largest in the history of our export trade, being $9,646,017, against $7,842,372 in 1899, $6,627,466 in 1897, and $5,509,188 in 1896, prior to which year the exports in this line had never aggregated so much as $5,000,000. In exports of sewing machines, typewriters, electrical and other intricate machinery, there are also gratifying increases. Comparing the export figures of the fiscal year just ended with those of 1898 and 1899, it is found that sewing machines increased from $3,136,364 in 1898 and $3,264,344 in 1899 to $4,540,842 in 1900; electrical machinery, from $2,052,564 in 1898 and $2,736,110 in 1899 to $4,328,917 in 1900; locomotive engines, from $3,883,719 in 1898 to $5,592,403 in 1900; typewriters, from $1,902,153 in 1898 to $2,697,544 in 1900; metal-working machinery. from $4,618,683 in 1898 to $7,193,390 in 1900; and all other machinery, from $13,336,930 in 1898 to $21,913,202. While our chief market for machinery is still to be found in European countries, an increasing proportion is being sold in the Far East, especially in British Australia, Japan, and India.

STORE LIGHTING.—In one after another of the Besse Syndicate of New England stores the Frink system of show-window and store lighting has been installed. As this work has extended over a period of two years, the proprietors have had ample time to test the efficiency and economy of the system. The new orders are a fair indication of the results. Among other recent important contracts reported by I. P. Frink are thirty of the Woolworth 5 and 10-cent stores in different parts of the country, in which the window reflectors are being installed. Rogers, Peet & Co., whose old store, at the corner of Warren Street and Broadway was burned last year, have installed the Frink reflectors in their new store at the same site, after having used and tested them in their store at Thirty-second Street and Broadway. The May stores at Denver, St. Louis (The Famous) and Cleveland, and particularly the six stories of show-windows of the Cleveland store, brilliantly lighted by the Frink system, we have referred to before in these columns. It would appear to be the same story—tried in one store, these reflectors are rapidly put into all the other stores under the same management. The co-operation of lighting men would often bring its own reward in better results from their work.

THE EMERSON ELECTRIC MANUFACTURING COMPANY is now working upon a large export order for alternating-current ceiling fans to be shipped to the Argentine. This order will be shipped Sept. 1, and consists of over 400 Emerson alternating-current ceiling fans, the shipment making a solid carload of large size. This order was captured in competition with American and European manufacturers, and is a very handsome tribute to the reputation of the Emerson apparatus in foreign countries. Another illustration of an unusual export order is that received by the Emerson Electric Manufacturing Company for ceiling fans to be shipped to Budapest, Hungary, to be operated on the very unusual frequency of 15 cycles per second, or 1800 alternations per minute. This frequency is much lower than anything used in the United States, the fans being used in railway cars which are operated by a three-phase current.

SHAH AFTER RAILROAD MATERIAL.—An agent of the Shah of Persia has, it is said, been examining New York trolley lines, stating that the Shah will build the longest line in Asia, 93 miles, between Teheran and a port on the Caspian Sea. John Marsden Ward, the Shah's agent, says: "I go to Philadelphia next week to visit the Baldwin Locomotive Works, with a view to making a report upon engines for use on the new railroad between Teheran and the Persian Gulf. One, and possibly a second line of railways will be pushed through to the Gulf with all possible speed. The roads will be built largely by Russian capital and Russian engineers, but I am supposed to be an authority upon machinery of all kinds, and my advice will be taken regarding the rolling stock." The Shah's purchases of automobiles, telephones and phonographs were noted in these columns last week.

BELDEN ARC LAMPS.—The Belden-Larwill Electric & Manufacturing Company, Fort Wayne, Ind., is a new reorganization of the old company, which has gone out of existence. It is a stock company under the laws of Indiana, and includes some of the best known and most influential men of the city. The new officers are: President, S. M. Foster; vice-president, M. C. McDougal; secretary, O. H. Larwill; treasurer, C. A. Wilding; general manager, E. H. Belden. The Belden system of arc lamps is to be vigorously pushed. The lamps are reported to have given great satisfaction, and to show a very high efficiency. A large business is expected during the present season.

ERIE TELEPHONE.—It is stated that the sub-companies of the Erie Telephone system increased their net earnings over 41 per cent for the six months ending June 30, as compared with the corresponding six months of last year. The gross income for the year 1900 will exceed $5,000,000, as compared with $3,600,000 for the year 1899. The Erie's proportion of the net earnings is at the rate of 9 per cent on the capital employed, and will average for the year the same as last year, namely, 10 per cent, after deducting all interest and fixed charges.

THE AMERICAN DISTRICT STEAM COMPANY reports an usually busy season thus far in the work of installing exhaust steam heating plants for electric light and railway companies. Following are some of the cities where the Holly system is being installed: Seattle, Wash.; Atlanta, Ga.; Champaign, Ill.; Youngstown, Ohio; Marinette, Wis.; Cumberland, Md.; Washington, Johnstown and Wilkinsburg, Pa. The Atlanta Railway & Power Company, of Atlanta, Ga., is having constructed more than two miles of underground steam mains.

MR. C. CAINS BROWNING, president of the General Equipment Company, Camden, N. J., manufacturers of magnetic circuit breakers, is now in Europe, looking after the interests of the General Equipment Company. This concern has an exhibit at the Paris Exposition, and it reports that it is now receiving good returns as the result. Mr. Browning will be in Europe for another month, a large portion of which time will be spent in Paris.

THE MILWAUKEE ELECTRIC COMPANY has secured a contract for the electrical installation of the Chicago and Alton Railway for its shops at Bloomington, Ill., amounting to about 1000 kw in generators and 1300 hp in motors. It has also secured a contract from the Wisconsin Central Railway for its new shops at Fond-du-lac, Wis.

THE DUNMORE STEEL AND IRON COMPANY, Dunmore, Pa., has recently decided to equip its plant with electricity and has placed an order with the Sprague Electric Company, in New York, for two split pole generators and 50 motors. The generators are 62½ and 100 kw, and the motors range from 3 to 20 hp.

SPRAGUE APPARATUS—Among other Sprague orders received for motors and generators, is one from the Cooke Locomotive and Machine Company, Paterson, N. J., for a standard 300-kw split pole generator of the belted type.

ELECTRICAL MACHINERY FOR CUBA.—The Morgan Engineering Company, of Alliance, Ohio, has just received an order for two large electric overhead travelling cranes for Havana, Cuba.

General News.

THE TELEPHONE.

MACON, GA.—A. W. Bisbee, of Jacksonville, Fla., has applied for a telephone franchise here.

BUFFALO, N. Y.—The Bell Telephone Company, of Buffalo, is building a line from Bliss to Arcade.

NEWTON, N. J.—The Sussex Telephone Company is extending its lines to Blairstown, in Warren County.

SPRINGFIELD, OHIO.—The Portsmouth Telephone Company has increased its capital from $50,000 to $100,000.

RALEIGH, N. C.—The Raleigh Telephone Company announces that it will be ready to begin work about Oct. 1.

LEBANON, IND.—The Advance Telephone Company, of Boone County, has been incorporated, with $2,000 capital.

COLUMBUS, OHIO.—The People's Telephone Company, of Shelby, Ohio, has increased its capital from $25,000 to $50,000.

GLEASON, TENN.—The Weakley & Carroll County Telephone Company has connected its lines here and put in a central office.

WILLIAMSTON, N. C.—The Williamston Telephone Company proposes to extend its line about thirty miles, in the near future.

ALVIN, TEXAS.—A twenty-year franchise was granted here to the Southern Telegraph & Telephone Company, of Palestine, Texas.

GRANT CITY, MO.—The Grant City Telephone Company, capital $2,000, has been incorporated by P. D. Anderson and J. F. Okey.

REPUBLIC, WASH.—A company is being formed here for the purpose of running a telephone line to Keller, a distance of 50 miles.

HARRISBURG, PA.—The Northeastern Pennsylvania Telephone Company, of Susquehanna County, has been incorporated. Capital, $10,000.

GLOUCESTER, OHIO.—The Union Telephone Company has been incorporated to install an exchange at this place. Capital stock, $1,500.

HARRISBURG, PA.—The Wellsboro & Gaines Telephone Company, of Tioga and Potter Counties, has been incorporated. Capital, $2,000.

PEKIN, ILL.—The Celestial Mutual Telephone Company, of Pekin, has been incorporated. Incorporators: J. M. James, James W. Bartlet and W. B. Cooney.

NEW LONDON, IA.—The Henry County Telephone Company has decided to build a line to Mt. Union. The company has increased the capitalization from $1,000 to $2,000.

CASTLE, N. Y.—The Bell Telephone Company is obtaining permission from property owners between this place and Portage. It will erect a line connecting the two villages this fall.

SENECA, ILL.—The Graves & Hayer Telephone Company, of Seneca, has been incorporated. Capital, $4,000. Incorporators: William A. Graves, Charles Hayer and Robert Knapp.

HOWE, TEX.—The Home Telephone Company, of Howe, has been incorporated. Capital, $5,000. Incorporators: W. L. Higginbotham, J. O. Matthews, G. H. Baxter, all of Howe.

HAGERSTOWN, IND.—The new independent telephone company has completed its line from this city to Economy, and is making rapid progress in extending its lines to other points.

SPOKANE, WASH.—The American District Telegraph Company, of Spokane, has been incorporated. Capital, $10,000. Incorporators: A. D. Campbell, T. P. McKinney, both of Spokane.

COLUMBUS, OHIO.—The West Jefferson Telephone Company has been incorporated. Capital, $6,000. Incorporators: R. W. Boyd, A. W. Milliken, W. Pence, W. E. Postle, F. W. Peirce.

FRANKLINVILLE, N. Y.—The Franklinville Telephone Company has been incorporated. Capital, $10,000. Incorporators: C. L. Randall, R. S. Litchfield, G. W. G. Ferris, all of Franklinville.

MACEDON, N. Y.—The Bickford & Kauffman Company will soon place an intercommuncating telephone system of ten instruments. Ernest W. Brown, of Macedon, will do the work of installing.

CLEVELAND, OHIO.—Judge Dissette, of this city, has granted an injunction in favor of a young lady restraining a young man from making love to her, or even calling her up by telephone.

COLUMBUS, OHIO.—The Bluffton Telephone Company, Bluffton, has been incorporated. Capital, $13,000. Incorporators: A. A. Geiger, F. M. Haller, H. O. Bentley, J. S. Brailey, W. H. Harper, Jr.

LYNNVILLE, TENN.—The Cumberland Telephone Company has increased its toll rates from this point to Murfreesboro, Nashville, Columbia, Lewisburg, Mt. Pleasant and a number of smaller places.

FREDERICKSBURG, VA.—The Tidewater Telephone Company, which has just completed a line from Gloucester Point to Newport News, will now construct a line from Gloucester Point to Tappahannock.

ST. LOUIS, MO.—The Kinloch Telephone Company last week paid over to the city of St. Louis about $16,000—5 per cent on the gross earnings during the eighteen months the company has been in operation.

LOGANSPORT, IND.—The Common Council, on the strength of special committee's report, refused to grant the Central Union Company an open franchise. They demand a stipulated rate to subscribers.

GUTHRIE, O. T.—It is announced that the Northern Oklahoma Telephone Company has disposed of its lines in Kay County to the Arkansas Valley Telephone Company. The consideration is said to be $10,000.

LEBANON, OHIO.—The Valley Telephone Company is opening up a number of farmers' community lines in this county. Toll lines are being built to Waynesville, Lytle, Pekin, Dodds, and a number of other villages.

SCOTTSBORO, ALA.—H. R. Godfrey, of Fort Payne, will build a long-distance telephone system that will connect this place with Fort Payne, Collinsville, Albertville, Chattanooga and many other towns in this section.

FALLS CHURCH, VA.—The Falls Church Telephone & Telegraph Company has purchased the telephone plant of M. E. Church and will probably build 100 miles of line during the present season, material for which will be needed.

CARTHAGE, MO.—Arrangements have been made to connect the Pierce City telephone lines recently purchased by T. J. Hyman, of Chicago, with the Springfield & Monet and the Pierce City & Reeds line with the Carthage exchange.

CHICAGO, ILL.—The National Telegraph News Company, of Chicago, has been incorporated to do a general telegraph and telephone business. Capital stock, $150,000. Incorporators: L. Martin, F. E. Crawford, W. R. Stewart, Jr.

FINDLAY, OHIO.—The recently organized Findlay Home Telephone Company has opened offices and has commenced work of construction. Solicitors are out, and it is expected that 800 telephones will be placed in operation at the start.

MILWAUKEE, WIS.—The south side telephone exchange was isolated from the east and west sides on Aug. 23 by the collision of a steamer and one of the company's submarine cables. The number of subscribers affected by the broken cable was about 1300.

LIMA, OHIO.—The Lima Telephone Company, of Lima, has been incorporated. Capital, $100,000. Incorporators: H. W. Neff, K. W. Huges, M. C. Purtscher, W. M. Miller, C. F. Stolzenback, all of Lima, Ohio; Cable & Parmenter, attorneys, Lima, Ohio.

THOMPSON, PA.—The Northeastern Pennsylvania Telephone Company, of Thompson, has been incorporated. Capital, $10,000. Incorporators: A. H. Crosier, S. S. Hubbard, both of Thompson; W. W. Mumford, of Starrucca; H. W. Kessler, of Brandt; F. J. Osgood, of Forest City.

TELEPHONE MANUFACTURING PLANT BURNED.—The extensive plant of the Maryland Telephone Construction Company in Baltimore, Md., was destroyed by fire on Aug. 22. The loss is estimated at $112,000, $75,000 of which is on the building and the balance on stock and tools.

CLINTON, IA.—Eastern capitalists have purchased the stock of the Tri-City Telephone Company and will extend the line. It is thought the National Telephone Company, which was recently incorporated at Trenton, N. J., is back of the deal and is after the business of the Bell Company.

NEW ORLEANS, LA.—The National District Telegraph Company, of Louisiana, Limited, has been incorporated to construct and operate systems of telegraph, telephone and electrical service. The capital stock is $100,000. H. D. Bennett, president; J. M. Stephens, vice-president; G. R. Johnson, secretary, and C. H. Haight, superintendent.

NEW ALBANY, IND.—A meeting of the representatives of the independent telephone companies in southern Indiana and Illinois was held here on Aug. 16 to arrange a system of long distance connections. The proposed system will extend from Indianapolis to St. Louis. A uniform rate was agreed upon, to go into effect when the companies are working together.

INDIANAPOLIS, IND.—Representatives of the Richmond Home Telephone Company and of the Fort Wayne Home Telephone Company were before the State Tax Board this week pleading for a reduction in the assessment for taxation. The former was assessed at $70,000 and was asked to reduce it to $25,000; the latter at $11,000, and was asked to reduce it to $4,000.

MUNCIE, IND.—The farmers in this county have the telephone fever. Three new companies have been formed and the rivalry for patronage is keen. The newest concern has completed its lines to Selma, and has eleven subscribers. Another company, with 22 telephones in use, has a line north of Selma, and still another in the northwest part of the county with 13 subscribers.

FORT WAYNE, IND.—The County Commissioners have granted to the New Haven Telephone Company a franchise including the right to construct lines from New Haven to Garr Creek, Shirley City, Baldwin, Edgarton, Adams Station, Maples, Harlan, Cedarville and Leo, all within Allen County. The Fort Wayne companies will doubtless make connecting arrangements.

SEATTLE, WASH.—The telephone controversy in this city, which has existed for the past month, has been settled in favor of the operators. The fight was a three-cornered one, the business men taking sides with the operators against the company. The latter finally yielded, and the girls have gone back to work at practically an advanced schedule of wages, shorter hours and reduction in the amount of work.

KINGSTON, N. Y.—At the annual meeting of the Citizens' Standard Telephone Company the following were elected directors: John H. Farrell, John M. Bailey, James H. Leake, Jay E. Klock, T. E. T. Mosher, S. N. Frederick and Cornelius Hill. The officers chosen were: John H. Farrell, Albany, president; Jay E. Klock, Kingston, vice-president; James H. Leake, Albany, treasurer; T. E. T. Mosher, Albany, secretary.

MILWAUKEE, WIS.—Articles of incorporation of the Farmers' Telegraph Construction Company were filed Aug. 24. The capital is given as $500,000, and it is said that the offices of the company will be in this city. Some time ago articles of incorporation were filed for the Central Telegraph & Telephone Company with a capital of $10,000. This name is now changed and the capital is increased. The incorporators are Charles Sawbill, A. E. Redfield and Martin Maylan.

DUNDEE, N. Y.—The Dundee Electric Light plant proposes to install a telephone system between Dundee and Eddytown, with an extension plug board at Dundee. It needs complete line equipment for this work, including instruments, cross-arms, insulators, wire, pins, plug board, braces, bolts, etc. The wire will be run on the electric light pole line. The company proposes to string a telegraph line later on. Address E. L. Bailey, of the company, for further particulars.

WARSAW, IND.—A number of business men of this city and the Straus Bros., bankers of Ligonier, have purchased the telephone system of the Warsaw Telephone Company, and all its franchises and toll lines in Northern Indiana. The entire property will be turned over to the new owners Sept. 1. New articles of incorporation will be filed under the name of the Kosciusko Telephone Company. The purchase price is said to be $25,000. Harry L. Inks, of Ligonier, will manage the affairs of the new concern.

RACINE, WIS.—The Citizens' Telephone Company has been incorporated by Frank L. Bliss, Charles R. Carpenter, John W. Knight, B. Hinrichs and John B. Simmons. The capital stock is $125,000, and the objects of the company are to operate and conduct the telephone business of Racine. The system will be operated under the franchise granted to Allin Sherman in October, 1899. Of $60,000 stock wanted, $40,000 has been pledged. All of the stock is and will be owned exclusively by Racine people. Work of construction will be commenced about Sept. 15.

ELECTRIC LIGHT AND POWER.

(See Supplement.)

THE ELECTRIC RAILWAY.

FORT WORTH, TEXAS.—The Glenwood & Polytechnic College Street Railway Company expects to establish two power houses.

LEBANON, OHIO.—Two companies, both headed by Dayton people, have applied for a franchise for an electric road from Dayton to Lebanon.

LOUISVILLE, KY.—The Ohio Valley Electric Railway Company, of Huntington, West Va., has filed articles of incorporation. Capital, $1,000,000.

PITTSBURG, PA.—The Consolidated Traction Company of this city has issued the report for July to the stockholders. The surplus earnings are given as $14,588.

LANSING, MICH.—The Lansing, St. Johns & St. Louis Electric Railway Company has decided to build the north end of the line this fall—between Alma and St. Louis.

DENISON, TEXAS.—The interurban electric line between Denison and Sherman will be built. Contracts for the equipment, boilers, generators, rails, ties, poles, etc., have been let.

CLEVELAND, OHIO.—The Cleveland Electric Railway Company is double-tracking its entire Euclid Heights line, doing away with practically the only strip of single-track road in the city.

EL PASO, TEXAS.—It is stated that two different companies are preparing to construct electric street railways in the city. H. M. Rush represents one syndicate and Z. T. White the other.

NEW ORLEANS, LA.—The New Orleans City Railroad Company has completed all the preliminaries towards the building of a new power house to supply all lines controlled by that company.

HOT SPRINGS, ARK.—The Hot Springs Street Railway Company has made preliminary arrangements for the erection of its proposed new plant. A Pittsburg engineer has prepared the plans.

FREDERICK, MD.—The Frederick Board of Aldermen extended the franchise of the Washington & Gettysburg Electric Railroad Company, which would have expired on Sept. 23, to April 30 next.

NEW HAVEN, CONN.—The directors of the Meriden, Southington & Compounce Street Railroad Company have voted to extend their line through Cheshire to Waterbury, a distance of 15 miles.

PITTSBURG, PA.—The United Traction Company, of this city, has started to reconstruct the lines on the Manchester branch of its system. The company will take out the T-rail and replace it with a heavy girder rail.

RAVENNA, OHIO.—The Portage Lakes Traction Company has been granted a franchise through this place. The road is to extend through Kent, Hudson and Bedford. Much of the right of way has been secured.

HARRISBURG, PA.—The Shenandoah & Pottsville Street Railway Company has been incorporated. Capital, $78,000. Incorporators: P. Evans, C. E. Hanna, G. H. Schuler, C. Newbold, W. B. Pedrick, all of Philadelphia.

STEUBENVILLE, OHIO.—The Steubenville, Mingo & Ohio Valley Traction Company has decided to enter the lighting field and is soliciting for business for lighting and furnishing power. A franchise will be asked for if enough business can be secured.

ALBANY, N. Y.—The State Railroad Commission has authorized the Central Park, North and East River Railroad Company, of New York City, and the Metropolitan Company, by which it is leased, to use the electric conduit system of motive power on Dey Street, between Greenwich and West Streets.

BARBERTON, OHIO.—The time limit for commencing work on a franchise granted to A. E. Townsend for the projected Barberton, Doylestown & Massillon Railway has expired, and will probably be forfeited. It is stated that Mr. Townsend is endeavoring to form a new company to carry out the project.

MUNCIE, IND.—A new electric railway is to be built between this city and Union City. The line will connect with the Springfield (Ohio) line, and will connect Cincinnati and intermediate points. John P. Martin, of New York, is interested in the new road.

BROOKLYN, N. Y.—The new style motor cars are to be placed on the Fifth Avenue elevated branch of the Brooklyn Rapid Transit Company's system as soon as they are equipped with the electric motors. Aisle room is saved by placing the seats about a half-foot behind one another at a slight angle.

BOSTON, MASS.—The directors of the Haverhill & Southern New Hampshire Street Railway have filed a certificate of incorporation. The line is to be six miles long and run from Haverhill, Mass., to Salem, N. H. The capital stock will be $60,000.

BOSTON, MASS.—A report of street railway operations for the year ending June 30 in Massachusetts shows that 15 new roads were organized, practically all of which are in operation now. During the 12 months 356,700,000 passengers were carried, an increase of 28,000,000 over preceding year.

PITTSBURG, PA.—Work has been started on the Creighton, Kensington & Springdale Street Railway, which will connect Tarentum, 15 miles from Pittsburg, with the neighboring towns in the Allegheny Valley. The road will cross the Allgheny River on the South Ninth Street bridge at New Kensington.

ROCHESTER, PA.—The cylinder heads of the large steam engine which runs the dynamo of the People's Electric Street Railway plant here, were blown out a few days ago, on account of which the plant had to be shut down for repairs. In the meantime electric current was furnished by the Beaver Valley Traction Company.

TACOMA, WASH.—A mortgage for $1,000,000 was given to secure bonds of the Seattle-Tacoma Railway Company, which is constructing an electric line between the two cities. The Fidelity Trust Company, of Tacoma, is trustee, and the interest and principal of the bonds are payable at the Chase National Bank, New York.

CLEVELAND, OHIO.—The stockholders of the Cleveland Electric Railway Company have decided to increase the capital stock of the company from $12,000,000 to $13,000,000. A portion of this money will go toward liquidating the floating debt, and the balance will be put into improvements, some of which are under way.

PITTSBURG, PA.—The West End Traction Company was sold last week to a local capitalist, Mr. M. K. McMullin, the consideration being between four and five million dollars. It is understood that Mr. McMullin bought the property for the Union Traction Company and will turn it over to that company.

ST. LOUIS, MO.—Articles of incorporation were filed Aug. 16 by the Interurban Construction Company, with a capital stock of $70,000. The shareholders are Thomas C. Harlan, Albert G. Blanke, Samuel A. Williams, H. C. Squire, H. D. Sebastian and Geo. P. Heckel. The business of the company will be the construcion of railways, building highways and roads.

TOLEDO, OHIO.—Capt. Luther Black, president of the Toledo, Bowling Green & Fremont Electric Railway Company has made a proposition to the Findlay Street Railway Company to jointly extend both lines and connect the two systems at the village of Galatea, thus making a through line from Toledo to Findlay. A branch line to Fostoria is also being talked of.

CLEVELAND, OHIO.—The Canton-Massillon Electric Railway Company has given a mortgage of $1,000,000 to the Cleveland Trust Company to secure a loan. The bonds are to bear interest at the rate of 5 per cent per annum, the last one to be payable in 1920. The money is to be used in lifting other bonded indebtedness and for improvements, including the changing of the road to standard gauge.

CLEVELAND, OHIO.—Euclid township property owners have appealed to the Cuyahoga County Commissioners, asking that the franchise of the Shore Line of the Cleveland, Painesville & Eastern Electric Railway be revoked. It is claimed that the tracks of the road are from 18 ins. to 3½ ft. higher than the road level, and that many accidents to vehicles have resulted. The complaint is of long standing.

SCRANTON, PA.—The Scranton Railway Company, a single track road, is installing signal lamp boxes in which it is impossible to change the signals without using a key. Formerly the men were greatly annoyed by mischievous boys changing the signals. Some weeks ago a serious head-on collision occurred and the testimony at the coroner's inquest tended to show that the signal lights had been tampered with.

BOSTON TO WASHINGTON.—The reported trolley line being planned from Trenton to New York is understood to be part of a projected long-distance line from Boston to Washington, promoted by J. F. Shaw & Co. The proposed line from Boston to Worcester is a part of the system to New York. Rights of way and toll bridges have already been fully secured from Trenton to Philadelphia, and are being sought south of that city.

DAYTON, OHIO.—The Southern Ohio Express & Freight Company, with a capital stock of $100,000, is in process of organization, and the incorporators will be leading officials of the interurban roads radiating from Dayton. The company will conduct freight and express business on all of these roads, and existing charges will be reduced. James M. Randall, at present with the Wells-Fargo Company, will probably be general manager of the company.

FREMONT, OHIO.—The first car on the Toledo, Fremont & Norwalk Electric Railway was placed in operation last week, and the road is now in operation between this place and Millbury. The company abandoned its efforts to secure a franchise through Monroeville, and has bought a private right of way around the town. Work on this portion is rapidly progressing, and as soon as it is completed the entire road will be in operation. The road is about 65 miles long.

PITTSBURG, PA.—All the necessary alterations of the Suburban Traction Company, of this city, have been completed, and the company has begun running cars directly down town over the Twenty-second Street bridge. An arrangement has been concluded with the Consolidated Traction Company, as well as with the United Traction Company, by which transfer tickets will be given to passengers from the Suburban lines over the lines east and west on the other lines.

CLEVELAND, OHIO.—The Cleveland City Railway Company has broken ground for a new car barn at the end of its Payne Avenue line. The structure will cost between $40,000 and $50,000, and will be sufficiently large to take care of the company's requirements in that portion of the city. The company is receiving the first of a lot of 60 double-truck cars, a number of which will be placed on the Payne Avenue line as soon as it is equipped with electricity, which will be within the next 30 days.

SYDNEY, C. B.—At a meeting of the Cape Breton Tramway and Electric Company, recently held here, it was decided to build an electric railway in the town of Sydney and suburbs, to engage an engineer, and, as soon as proposed routes will be surveyed, to commence the construction of the tramway. A com-

mittee was appointed to consider the advisability of extending the line to Glace Bay. The construction of the line between North Sydney and Sydney mines was considered, but not decided on. The company is capitalized at $500,000.

PITTSBURG, PA.—W. Redwood Wright and W. Frederick Snyder, Philadelphia capitalists, who recently purchased all the electric street railways in the Beaver Valley, have paid over the purchase money. They stated that all the lines in the Beaver Valley will be consolidated and a number of improvements will be inaugurated. The People's line, of Rochester, Pa., will be extended from Freedom to Conway, and from Rochester across the Ohio River to Monaca. The contemplated improvements will cost $200,000, and will be begun at once.

PITTSBURG, PA.—The annual meeting of the board of directors of the Birmingham Traction Company was held last week, and the following gentlemen were elected for the coming year: Harry Moore, A. C. Wettengel, James S. McKelvey, William R. Ford, John C. Fisher, David Yost and Jacob Hook. The officers are: Harry Moore, president; Weaver H. Rogers, secretary and treasurer; A. B. Betz, assistant secretary, and T. J. Layton, superintendent. According to the financial statement the net earnings for the year were $127,508.48.

ALTON, ILL.—The Alton Railway, Gas & Electric Company will continue to supply the patrons of the Alton Electric & Service Company, which was disabled by an accident to the machinery of the power house last week. The officers of the Alton Railway, Gas & Electric Company are considering a proposition to purchase the plant of the new company. The new company, which has closed down for an indefinite period, was organized less than six months ago. It began operations two months ago, and has been unprofitable because of the cutting of rates.

INDIANAPOLIS, IND.—In response to a request by the State Tax Board the Indianapolis Street Railway Company submitted the following itemized statement of the expenses of the company: The statement shows that gross receipts from May 3, 1899, to April 1, 1900, were $982,370.54; annual salaries to officers, $43,447.12; wages paid to employees, $355,753.76; for legal expense, rent, damages, nuisance, advertising and supplies, $105,799.83; for improvements, $1,263,243.31. Under the head of "fixed charges" are interest on bonds, $330,000; taxes, $49,031.90; special city tax, $27,300; total fixed charges and improvements, $1,669,756.21, leaving a deficit, as contended, of $687,404.67.

THE AUTOMOBILE.

DETROIT, MICH.—The Automobile Rapid Delivery Company has been organized here with a capital stock of $25,000.

NEW AUTOMOBILE COMPANY.—The Stearns Automobile Company, of Philadelphia, was incorporated at Dover, Del., with a capital of $1,000,000.

THE MARYLAND AUTOMOBILE MANUFACTURING COMPANY has been incorporated at Cumberland, Md. The company's shops will be in Westernport, Md.

THE CHAMBERSBURG OMNIBUS COMPANY has been chartered to operate automobiles in Chambersburg, Pa. It will probably establish a full line of autocarettes for a regular route in the town.

AUTOMOBILES IN CHICAGO.—Three lines of electric omnibuses intended to compete with the street cars for patronage in all parts of Chicago are projected. The first electric vehicles will probably be in operation by October.

TO STUDY THE AUTOMOBILE.—The machine shops at the Rose Polytechnic Institute, Terre Haute, Ind., are being equipped with new machinery, and during the approaching term much attention will be given to the study and building of the automobile.

AUTOMOBILE RACES IN NEWPORT.—Mr. W. K. Vanderbilt, Jr., will have a series of automobile races at Aquidneck Park, in Portsmouth, on the afternoon of Sept. 6. He will offer some valuable prizes, and all classes of automobiles will be represented, including electric.

THE AUTOMOBILE EXHIBITION.—A. R. Shattuck, chairman of the exhibition committee of the Automobile Club of America, states that all the floor space in the Madison Square Garden, New York City, for the show of Nov. 3-10, has been taken by intending exhibitors, and the demand for space has been so great that it has been decided to floor over the boxes on the north side of the Garden, and also to exhibit automobiles in the restaurant. The following manufacturers will exhibit their products: The National Automobile & Electric Company, Riker Motor Vehicle Company, Winton Motor Carriage Company, F. A. LaRoche & Co., DeDion-Bouton Motorette Company, United States Automobile Company, L. M. Harris, the Autocar Company, Foster Automobile Manufacturing Company, Automobile Company of America, Woods Motor Vehicle Company, Stanley Manufacturing Company, Locomobile Company of America, Canda Manufacturing Company, American Electric Vehicle Company, Daimler Manufacturing Company, Waltham Manufacturing Company, American Bicycle Company, Electric Vehicle Company, Overman Auto Company, the Knox Auto Company, Holyoke Auto Company, Jos. Dixon Crucible Company, Diamond Rubber Company, Rose Manufacturing Company, Consolidated Rubber Tire Company, Gleason-Peters Air Pump Company, Goodyear Tire & Rubber Company, Dow Portable Elec. Asst. Company, Chas. E. Miller, Veeder Manufacturing Company, B. F. Goodrich Company.

NEW INDUSTRIAL COMPANIES.

TRENTON, N. J.—The Electric Maintenance & Inspection Company, Camden, has been incorporated. Capital, $10,000. Incorporators: W. J. Cowes, G. P. Steel, J. Allen and C. Howell.

TRENTON, N. J.—The Williams Electric Steam & Water Gauge Company, of East Orange, has been incorporated to deal in electric, steam and water gauges. Capital, $125,000. Incorporators: F. Williams, C. L. Abbott, A. R. Fulton, J. W. Brillan; J. B. Dill, attorney, New York City.

LEGAL.

MUNICIPAL PLANTS NOT TAXABLE.—On appeal made by the Washington (Ind.) Electric Light Company from an assessment made by the County Board, the State Tax Board dismissed the case on the opinion of the Attorney-General that property belonging to a municipal corporation is not assessable for taxation.

THE STANDARD PNEUMATIC TOOL COMPANY, Marquette Building, Chicago, Ill., writes to the effect that a large number of users and prospective users of pneumatic tools are under the impression that suit has been entered against it by one of its competitors for infringement of patents, on account of the fact that they have brought suit against various pneumatic tool companies. The Standard Company states that it is not involved in any way, shape or manner in the present litigation, as its "Little Giant" pneumatic tools are fully covered by patents the validity of which is not questioned by any one.

THE RIGHTS OF MAJORITY STOCKHOLDERS.—Judge Bell, of Blair County, Pa., rendered a decision of importance recently upon the rights of the majority and minority stockholders of a corporation. Fifty-three per cent of the capital stock of the Edison Electric Illuminating Company, of Altoona, is owned by the Electric Company of Philadelphia, and the remaining 47 per cent is owned by Altoona capitalists. The minority stockholders sought to issue 650 shares of new stock and auction the same to the highest bidder. The Philadelphia capitalists secured an injunction, alleging that their rights as majority stockholders were being endangered by this procedure. The court made the injunction perpetual, holding that majority stockholders had a right to a majority of new stock at a fair market value, so as to preserve their control, and that the tendency of auctioning stock is to give the minority an unfair advantage over the majority.

PERSONAL.

MR. W. A. ROSENBAUM, the well-known patent attorney, has been called abroad on business, and leaves next week for London, Paris and Berlin.

MR. G. U. G. HOLMAN, a well-known electrical and mechanical engineer, who has had considerable central station experience, has joined the forces of the General Electric Company.

MR. LUTHER STIERINGER, consulting electrical engineer of the Pan-American Exposition, has recovered from a very serious illness, and after a period of recuperation at the seaside and in the mountains, has resumed his important work at Buffalo.

MR. H. C. DODGE, at present with the Victor Electric Company, and formerly with the American Electric Telephone Company, will be identified with the Williams-Abbott Electric Company, of Cleveland, after Sept. 1. The Williams-Abbott Company has secured the right to manufacture under patents on telephone switchboards owned by Mr. Dodge, and will shortly announce a complete switchboard and other new apparatus in connection with its line of telephone instruments and parts.

MR. GEORGE STANMORE, late of the Columbia Electrical Supply Company, has opened an office at 115 Broadway, New York, where he expects to represent some well-known specialties in the electrical business. Mr. Stanmore was for a number of years connected with the A. K. Warren Company, of New York, and the Electrical Maintenance Company. Prior to that he was with Bergmann & Co. and the Edison General Electric Company. He has completed this year one of the most unique electrical installations in the United States, that of G. C. Tilyou's great steeplechase at Coney Island, N. Y.

EDUCATIONAL.

Y. M. C. A. WORK.—The international committee of the Young Men's Christian Associations has issued its annual report, and the prospectus concerning its work throughout North America. The report gives in detail the record of the year's work, including that of the 134 evening schools taking the recent international examinations, the list of 1498 successful students, and the names of the 108 colleges and universities which are encouraging this work to the degree that they give official recognition to its international certificates. The prospectus contains a brief outline of the movement, its objects, the list of examiners, the syllabi of outlined courses of study in the 26 fundamental subjects now provided; also the regulations governing the rigid examinations, and the complete sets of questions used last year. Last year in 350 associations, 26,000 young men received instruction through the winter season from 1215 teachers. The headquarters of the committee are at 3 West Twenty-ninth Street, New York, Mr. George B. Hodge being secretary of the educational department.

STUDY IN AUSTRALIA.—The rapidly-increasing number of people in foreign countries who are taking up correspondence courses of instruction shows that a great distance between the student and the school is not objectionable when studying by mail. The International Correspondence Schools, Scranton, Pa., have students in over a hundred foreign countries who are successfully studying many branches of engineering. The schools have an especially large number of students in Australia and New Zealand. In the latter country they are represented at Auckland, and also at Wellington, by Geo. A. Troup. This representative furnishes catalogues and any desired information regarding the schools. To insure students having something on hand to study while their lessons are on the way to and from Scranton, where they are corrected, more papers are furnished at one time to those living at a great distance, and no matter how rapidly the papers are finished, there is no waiting for lessons. The electrical courses of the International Correspondence Schools include one in electrical engineering and others in electric power and lighting, electric railways, electric car running, telegraphy and telephony.

Trade Notes.

MR. F. W. BARNACLO, patent attorney, Equitable Building, Baltimore, Md., has enlarged his offices to take better care of his increasing business.

COLUMBIA LAMPS.—The Columbia Incandescent Lamp Company, St. Louis, Mo., has issued a revised net price list of its incandescent lamps.

THE AMERICAN ELECTRIC VEHICLE COMPANY has received a gold medal from the Paris Exposition. Its exhibit has been illustrated in these pages.

ELASTIC BOOKCASES.—The Globe-Wernicke Company, Cincinnati, Ohio, has issued a leaflet briefly describing the special features of the Wernicke elastic bookcase.

THE STANDARD TELEPHONE & ELECTRIC COMPANY, Madison, Wis., which makes a full line of telephone apparatus is working its plant up to full capacity in order to supply the demand for its goods.

THE BALL ENGINE COMPANY, of Erie, Pa., who furnished the 350-hp engine for the electric motive power for the special machinery exhibit of the United States at the Paris Exposition, has been awarded a gold medal by the Exposition authorities.

THE SAFETY-ARMORITE CONDUIT COMPANY, Rankin Station, Pa., is erecting two new buildings, one of which is 100 x 260 ft., and the other 150 x 150 ft. Both are of iron construction throughout, and the contracts for their erection have been let to the American Bridge Company.

TELEPHONE TERMINALS.—The American Electric Telephone Company, 36 West Jackson Boulevard, Chicago, Ill., has issued a leaflet pointing out the special features of the Burns combination office terminal. By the use of this device, absolute protection is assured to all parts of the switchboard.

DEMAND FOR OIL FILTERS.—The repeat orders for Cross oil filters, manufactured by the Burt Manufacturing Company, Akron, Ohio, were, it is reported, as large and numerous in July as the best month in '99, and the increase over the midsummer months of a year ago is quite extraordinary.

THE ELECTRIC SUPPLY & CONSTRUCTION COMPANY, Columbus, Ohio, has changed ownership and management, P. B. Chaney, the former manager, disposing of his interest to Mark Simonton, who becomes treasurer and general manager. John Cashatt is president, and William Simonton, secretary, of the new company.

THE FARR TELEPHONE & CONSTRUCTION SUPPLY COMPANY, Chicago, Ill., has issued catalogue No. 14, on telephone supplies. The catalogue contains 48 pages, and is very completely illustrated, showing an extensive line of instruments and supplies. It contains considerable information of interest to practical telephonists.

ELECTROLYSISPROOF CONDUIT.—The Electrolysisproof Conduit Manufacturing Company, 605 Manhattan Building, Chicago, Ill., a few days ago booked an order for 180,000 ft. of its electrolysisproof conduit from one of the largest telephone companies. It is evident that the advantages of this conduit are being appreciated.

PARIS MICA AWARD.—The Mica Insulator Company, 218 Water Street, New York, has been awarded a gold medal at the Paris Exposition. Its exhibit was very complete and unique, and contained a great many specimens of mica as well as micanite. Reference to this exhibit was made in the ELECTRICAL WORLD AND ENGINEER of July 7.

THE NEW ENGLAND MOTOR COMPANY, Lowell, Mass., in its bulletins Nos. 30 and 31 describes and illustrates its direct-current motors and generators, types M E and E. The special features of these machines are carefully pointed out and illustrated. The company is now producing new eight-pole slow-speed direct-connected motors and generators.

AWARD FOR LEATHER BELTS.—Messrs. Chas. A. Schieren & Co., New York, have received notice by cable that they have been awarded a gold medal at the Paris Exposition for the superiority of their leather belting and belting leather, especially for their perforated electric leather belts for street railway use, large specimens of which were exhibited.

THE PACIFIC ELECTRIC COMPANY says that it is placing its lamps this season before the public in better shape than ever; that they are guaranteed to be correct in construction; that its new process of enameling is perfect and gives a smooth enamel finish without cracking the metal. There is no spoiling of the lamps through overheating of the enameling oven.

THE BURNLEY BATTERY & MANUFACTURING COMPANY, Painesville, Ohio, reports an increase in battery and paste sales of nearly 100 per cent over July and August sales of 1899. The Burnley soldering paste is a standard article in the electrical trade, and its constant growing appreciation is evidenced by the unusual amount of orders which this company has been lately receiving.

MILWAUKEE, WIS.—The Barth Manufacturing Company is manufacturing an electric elevator that has new features, and which is meeting with great favor. Several large contracts have been secured lately, mostly for elevators with the motor direct attached. The controller is the work of Mr. John Dillon, who is now interested in this company. Mr. Dillon is well known to the elevator fraternity.

EXPORT ORDERS FOR OIL FILTERS.—The Burt Manufacturing Company, of Akron, Ohio, reports having made some important shipments of its Cross oil filters on export orders in the past month. These orders came from Denmark, Sweden, Spain, France, England and Mexico. The company states that, notwithstanding the unsettled condition of Europe, its export business is steadily increasing.

THE CAPE NOME CABLE.—Messrs. Alexander Klein, G. F. Porter and R. D. Brixey, of New York, are in San Francisco en route to St. Michaels, where they will oversee the work of laying the United States Government cable to Cape Nome. The greater part of the cable has arrived, and the cable and supplies will be shipped north on the steamer Orizaba. Gen. A. W. Greely, of the Signal Service, will take the steamer.

THE LIBERTY ELECTRIC LIGHT COMPANY has been organized in Boston, to manufacture the lamp invented by Mr. Samuel B. Husselman. This company is incorporated with a capital stock of $50,000. Mr. C. H. Lewis, of Boston, is president, and Mr. Husselman is treasurer. It is expected to get a plant in running order in Malden, Mass., by Sept. 1. The necessary machinery will be installed to produce 1000 lamps a day.

THE STANDARD WELDING COMPANY, Cleveland, Ohio, is mailing a very handsome and tasteful catalogue illustrating and describing some of the latest developments in metal work construction involving the use of its electric welding process. At present the company is very busy in the production of top pole rings for telephone and telegraph poles. The catalogue is the work of Mrs. McIntosh, the company's advertising manager, one of the few ladies occupying such a position for a large manufacturing concern.

THE BRITISH ELECTRIC WORKS COMPANY, LTD., Birmingham, England, has placed before the electrical trade a few advance sheets of its catalogue, which will shortly appear. The pamphlet recently issued contains illustrated descriptions of the company's "Stellite" sockets, switches, fuse blocks, etc. The business of this company is continually extending, improvements in its apparatus being constantly introduced, so that it has thought it advisable to wait a short time before issuing the more comprehensive catalogue.

CATALOGUES IN FOUR LANGUAGES.—In order to secure trade, one of the important means is to set forth the merits and other features of the goods offered in the language of the people to whom they are offered. This has been done by the Holophane Glass Company, New York, in bringing out its catalogue in four different languages, viz., English, French, Spanish and German. The catalogues are uniform in get-up; printed in two colors, and well illustrated. The special features of Holophane globes are very carefully brought out and discussed.

THE CLEVELAND PUNCH & SHEAR WORKS, Cleveland, Ohio, manufacturers of machine tools, are preparing to erect a large addition to their plant, which will be changed to electric drive. Contracts have been placed for a 180-hp engine with the Skinner Engine Company, Erie, Pa., and for a 100-kw alternating current generator with the Westinghouse Electric & Manufacturing Company. There will also be a 20-ton 3-motor alternating current traveling crane and a 200-hp boiler. The boiler will be equipped with automatic stoker. With this addition the company will have a plant 156 ft. x 160 ft., and three stories high.

THE RICHMUNDT ELECTRIC WIRE CONDUIT COMPANY, of Milwaukee, Wis., has given the Electric Appliance Company, of Chicago, the agency for its conduit for seven States. The Richmundt Company is manufacturing a new conduit. The exterior of the iron pipe is electro-galvanized, every part of the metal being impregnated with zinc, thereby making it smooth and rustless, and by enameling the interior an ideal conduit is the result. Bending and handling this tubing does no damage, as the enamel cannot break from the interior, and the electro-galvanized exterior is so excellent that no appreciable deterioration is perceptible.

BULLOCK APPARATUS.—"What we build, and the names of a few of our patrons," is the subject of bulletin No. 37, issued by the Bullock Electric Manufacturing Company, Cincinnati, Ohio. The company is frequently asked if it builds this or that kind of a dynamo or motor, and where its machines may be seen in operation. This bulletin has been compiled with a view to answering such inquiries, and at the same time to give interested persons an idea of its manufacturing facilities by publishing some views of its works. Excellent halftones of the apparatus and the factory are shown, and the list of establishments in which Bullock apparatus is installed is a long one indeed. It covers thirteen pages of the bulletin and on another page a list of foreign users is given.

GREENFIELD FLEXIBLE STEEL ARMORED CONDUCTORS have proved such a success that the Sprague Electric Company has been obliged to increase its manufacturing plant. Its adaptability to ship wiring is evident, as a rigid conduit system can only be installed at great cost, owing to the form of the vessel's structure, the small space available, the excessively high temperature, and the incessant vibrations of the ship. In shop and mill work the flexible steel armored conductors do away with the insulating knobs and cleats and the objectionable features of dust-collecting open wiring, while for interior conduit service they allow of a uniformity in conduit and exposed work which greatly facilitates the contractor's operations.

HUGO REISINGER, 11 Broadway, New York, sole importer of "Electra" highest grade Nuernberg carbons, reports that business for the past season has been exceedingly satisfactory. Mr. Reisinger, who has just returned from Europe, states that in consequence of the enormously increasing demands for high grade carbons, the European factory has been again compelled to enlarge its very extensive works, which are by far, it is claimed, the largest carbon works in the world, giving employment to about 1200 men. In its efforts to maintain the standard quality of its carbon products, the factory has been eminently successful, and it is claimed that the "Electra" carbons remain unexcelled in quality and efficiency. With the larger facilities, Mr. Reisinger will be able to respond promptly to en expected increase in the demand for "Electra" carbons for the coming season.

RENEWING INCANDESCENT LAMPS.—Within the past five years numerour concerns have started in the business of renewing burned out incandescent lamps. For various reasons many of them have not been successful, and have gone out of business after one or two season's trial. The Re-New Lamp Company, of 126 State Street, Boston, Mass., has, however, built up a splendid business in this line. It shows the courage of its conviction—that a lamp carefully and scientifically refilled, will give as good and as long service as a new lamp—by backing it up with substantial investment of money. It started in the business of refilling lamps three years ago in a small way. To-day it has one of the best equipped plants in the East for this class of work, with 20,000 sq. ft. of floor space, a capacity of 6000 lamp a day, 100 skilled and experienced operators and machinery and appliances of the very best. Its sucess, however, lies in the fact that it turns out a superior lamp, and is prompt in the execution of orders. It is, as it puts it, in business not to see how much money it can make in a short time, but to give a high standard lamp in every respect and at a reasonable profit.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED AUG. 21, 1900.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

656,158. CONFINER OF WIRES FOR ELECTRICAL CONNECTIONS; C. F. Ash, New York, N. Y. App. filed Dec. 11, 1899. The screw of a binding post presses together the sides of a U-shaped metal clip, in the bend of which the wire is clamped.

656,165. ELECTRIC GENERATING APPARATUS; J. H. Bickford, Salem, Mass. App. filed Dec. 8, 1899. The dynamo is regulated by automatically controlling the flow of fuel to the engine which drives it.

656,177. COMMUTATOR; J. T. H. Dempster, Schenectady, N. Y. App. filed June 8, 1900. To prevent displacement of the segments, they are locked together by means of a key engaging with each of them.

656,192. MANUFACTURE OF PIPES OR CONDUITS FOR ELECTRICAL PURPOSES; A. H. Howard, London, England. App. filed May 18, 1900. The pipe is made by placing a quantity of liquid asphalt into a tube and rotating it, causing the asphalt to spread over the interior of the tube.

656,207. TROLLEY WHEEL; H. A. Osborne, Plainville, Conn. App. filed Dec. 6, 1899. The flange of the wheel is formed with cutting ribs to remove ice and sleet.

656,266. SYSTEM OF ELECTRICAL DISTRIBUTION; H. F. Roach, St. Louis, Mo. App. filed July 10, 1899. This invention is for regulating a variable speed dynamo; automatic means are provided for varying the value of a shunt-coil opposed to a separately excited field coil.

656,276. ELECTRIC RAILWAY SYSTEM; L. E. Walkins, Springfield, Mass. App. filed Dec. 15, 1898. This is a third-rail system in which the third rail is divided into sections the circuits of which are mechanically controlled by the car wheel.

656,282. CIRCUIT-BREAKER; G. W. S. Brubaker and W. S. Twining, Philadelphia, Pa. App. filed Nov. 20, 1899. A second circuit is automatically controlled by the action of the making or breaking of the main circuit.

656,284. SYSTEM OF NON-INTERCHANGEABLE CONTACT PARTS; M. Froschl, Vienna, Austria. App. filed Sept. 2, 1899. Details of construction.

656,291. SWITCH; E. W. G. C. Hoffmann, Schlotenberg, Germany. App. filed Sept. 2, 1899. The speed of the contact-making portion is reduced considerably by movably mounting both of the contact members and causing them to move in opposite directions.

656,305. PROCESS OF ELECTROLYTICALLY EXTRACTING ZINC FROM ORES; W. Strzoda, Falenze, Germany. App. filed Jan. 2, 1899. The process of electrolytically extracting zinc from its ores which consists in placing the disintegrated or pulverized ore in its natural state in an electrolytic vat containing an aqueous alkali-metal solution capable of dissolving the ore with production of a zincate and in direct contact with the cathode, and closing the circuit through the vat, thereby precipitating the zinc and the alkali metal at the cathode, the alkali metal reacting with the water to regenerate the solvent solution.

656,309. ELECTRIC BURGLAR ALARM; P. B. Vandevalde, New York, N. Y. App. filed Feb. 16, 1900. Details.

656,323. ELECTRIC BICYCLE; A. Hansel, Zeitz, Germany. App. filed Feb. 1, 1899. A dynamo and a storage battery are mounted on the vehicle, the former being driven from one of the wheels and arranged to charge the battery from which current is taken to light a lamp and ring the alarm bell.

656,324. CONTROLLING ELECTRICAL CURRENTS; A. H. Holmes, Liverpool, England. App. filed April 11, 1899. An automatic mechanism is so arranged that when an excess of current takes place it breaks the main circuit and sends the current through a secondary circuit containing a resistance, keeping the main circuit open until the cause of the excess is rectified.

656,333. TELEPHONE SWITCHBOARD APPARATUS; T. C. Wales, Jr., Newton, Mass. App. filed Nov. 7, 1899. Extra sections of the switchboard are provided so that the operators may be shifted around to make their work more uniform.

656,336. SWITCHBOARD FOR TELEPHONES; M. I. Baird, Glenfield, Pa. App. filed March 1, 1900. All the connections necessary to be made to connect and disconnect two subscribers, except the insertion of the plugs, are effected automatically and in proper sequence on the removal or replacing of the receivers of the subscribers, or the ringing of the bell, as the case may be.

656,341. LOCK CONTROLLING DEVICE; H. G. Carleton, New York, N. Y. App. filed Nov. 9, 1899. The idea is to arrange a system of electrically controlled locks that all the locks may be operated simultaneously and each lock independently.

656,372. GUARD FOR CONTROLLER BRUSHES; A. L. Riker, New York, N. Y. App. filed Jan. 8, 1900. The guard prevents the controller brushes from catching upon the controller segments.

656,384. SWITCHBOARD FOR TELEPHONE; M. I. Baird, Glenfield, Pa. App. filed Dec. 1, 1899. The object of this invention is to provide for the automatic removal of the plug from the switchboard and its removal out of the way of the operator on the hanging up of the receiver by the subscriber.

656,421. BRUSH HOLDER RING; H. G. Reist, Schenectady, N. Y. App. filed Aug. 5, 1898. The ring upon which the brush holders are carried is fitted into a circular groove in the field magnet, and is adjustable bodily therein.

656,434. COMBINED VISIBLE AND AUDIBLE SIGNAL; E. W. Vogel, Chicago, Ill. App. filed July 7, 1899. The current is shifted alternately into the visible and audible signals.

656,451. AUTOMATIC CIRCUIT INTERRUPTER; L. Fleischmann, Schenectady, N. Y. App. filed July 12, 1899. A fuse is located in an enclosure containing an explosive gas, so that when the fuse is destroyed, the arc is blown out by the explosion and rupture of the inclosure.

656,454. SYSTEM OF NON-INTERCHANGEABLE ELECTRICAL CONTACT PARTS; M. Froschl and R. Hundhausen, Vienna, Austria. App. filed March 6, 1899. Details.

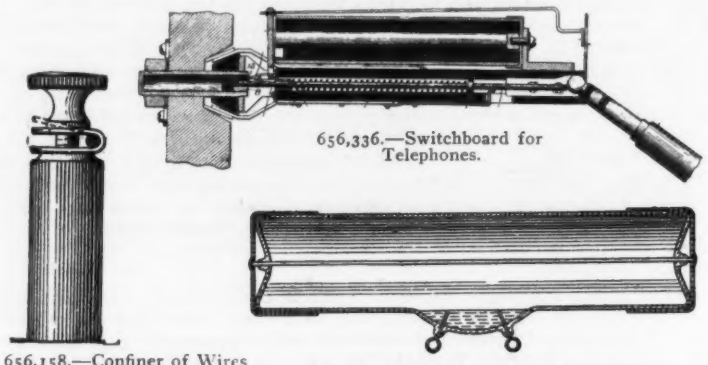
656,455. SUMMATION METER; J. Harris, Lynn, Mass. App. filed July 17, 1899. A summation meter comprising a plurality of actuating devices for a register common to all, a lock for the actuating devices set when two or more meters act simultaneously, and interconnections permitting the lock to be removed from the several actuating devices in sequence.

656,473. ELECTRIC CONTROLLER; C. J. Reed, Philadelphia, Pa. App. filed Jan. 13, 1899. A controller constructed especially for a certain method of operating translating devices described in other patents of the same patentee.

656,511. ELECTRIC RAILWAY SYSTEM; G. M. Campbell, New York, N. Y. App. filed Dec. 15, 1899. A trolley carrying an armature traverses a conduit by the attraction of a magnet on the car. The trolley completes the circuit between the main and sectional conductors.

656,522. APPARATUS FOR CONVERTING ALTERNATING CURRENTS INTO CONTINUOUS CURRENTS; M. Deri, Vienna, Austria. App. filed July 6, 1899. The invention relates to the construction of such converters with stationary magnets and induced coils in which the continuous current produced is taken from points that are stationary, thus decreasing the importance of the brush action.

656,545. ELECTRICITY METER; G. Hookham, Birmingham, England. App. filed July 9, 1900. The invention consists in automatically synchronizing



656,336.—Switchboard for Telephones.

656,158.—Confiner of Wires for Electrical Connections

656,451.—Automatic Circuit Interrupter.

two pendulums by means of a beam or balance gear at periodic intervals in an electricity meter, in which registration is effected by deviations from normal time produced in one pendulum by the current or energy to be measured, neither pendulum being affected by the current to be measured during said periodic intervals.

656,558. ELECTROLYTIC APPARATUS; G. Loiselet, Paris, France. App. filed Nov. 7, 1898. The invention consists of a cell whose bottom and end walls are made of non-conducting material and whose side walls are constructed of narrow strips of vulcanized fibre or other porous material secured to said bottom and end walls, and also secured and held in placed by perforated metallic plates, to which are connected, respectively, the positive and negative poles of a source of electrical energy.

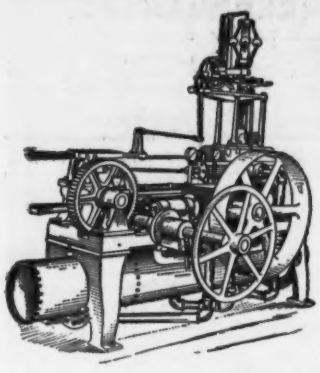
656,571. CONTROLLER FOR ELECTRIC MOTORS; T. S. Perkins, Idlewood, Pa. App. filed Jan. 13, 1900. To destroy arcs electromagnets and arc shields are used provided with magnetic flux conductors which project between adjacent fingers and into proximity to the pole pieces of the magnet.

656,578. SYSTEM OF ELECTRICAL DISTRIBUTION; W. J. Davis, Jr., Schenectady, N. Y. App. filed June 29, 1900. The invention consists in running the synchronous machines in multiple at light loads, while at heavy loads each machine is separately supplied from an independent source of current.

656,584. SIGNALING APPARATUS; C. R. Perrine, Goldfield, Colo. App. filed April 10, 1899. The important feature of this apparatus is that the switch is provided with a watertight casing adapting it for use in mines.

656,599. PROCESS OF MANUFACTURING CARBIDS; R. Doolittle, Chicago, Ill. App. filed Oct. 6, 1896. The process consists in first mixing together pulverized carbon and a suitable base in suitable proportions; second, passing the mixture in a shower through a flame; third, passing the heated mixture and accompanying gases through a zone of increasing temperature including an electrical furnace where the mixture becomes transformed into a carbid, and, fourth, drawing off the superheated gases and permitting the carbid to cool, the whole constituting a continuous process.

656,600. MEANS FOR MANUFACTURING CARBIDS; R. Doolittle, Chicago, Ill. App. filed Oct. 16, 1896. The apparatus for carrying out the process described in the preceding patent.



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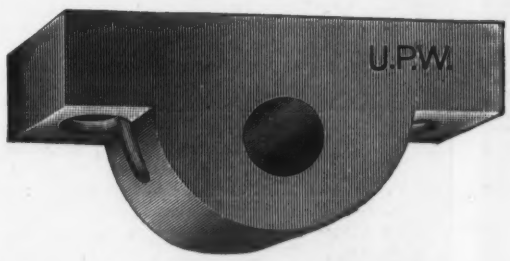

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Read Claim 3d

BURNLEY'S PASTE PATENT

No. 608,973. Application filed June 3d, 1895. Allowed Aug. 9th, 1898.

Claim 3d. "A plastic flux or soldering paste for use in joining bodies of metal with solder. The same consisting of a flux in solution mixed with a fat or grease that is pasty at ordinary temperatures, substantially as described."

Note that this claim covers broadly any flux incorporated with a pasty grease.

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WANTED—Salesmen to sell incandescent lamps as a side line on commission. Address THE CONSOLIDATED ELEC. LAMP CO., Danvers, Mass.

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WANTED—Any one having for sale a large size second-hand multipolar dynamo, 110-volt, direct-current, and with carbon brushes, can find a cash customer by addressing, with full particulars, "D. H. M.," care Electrical World and Engineer, 120 Liberty St., New York.

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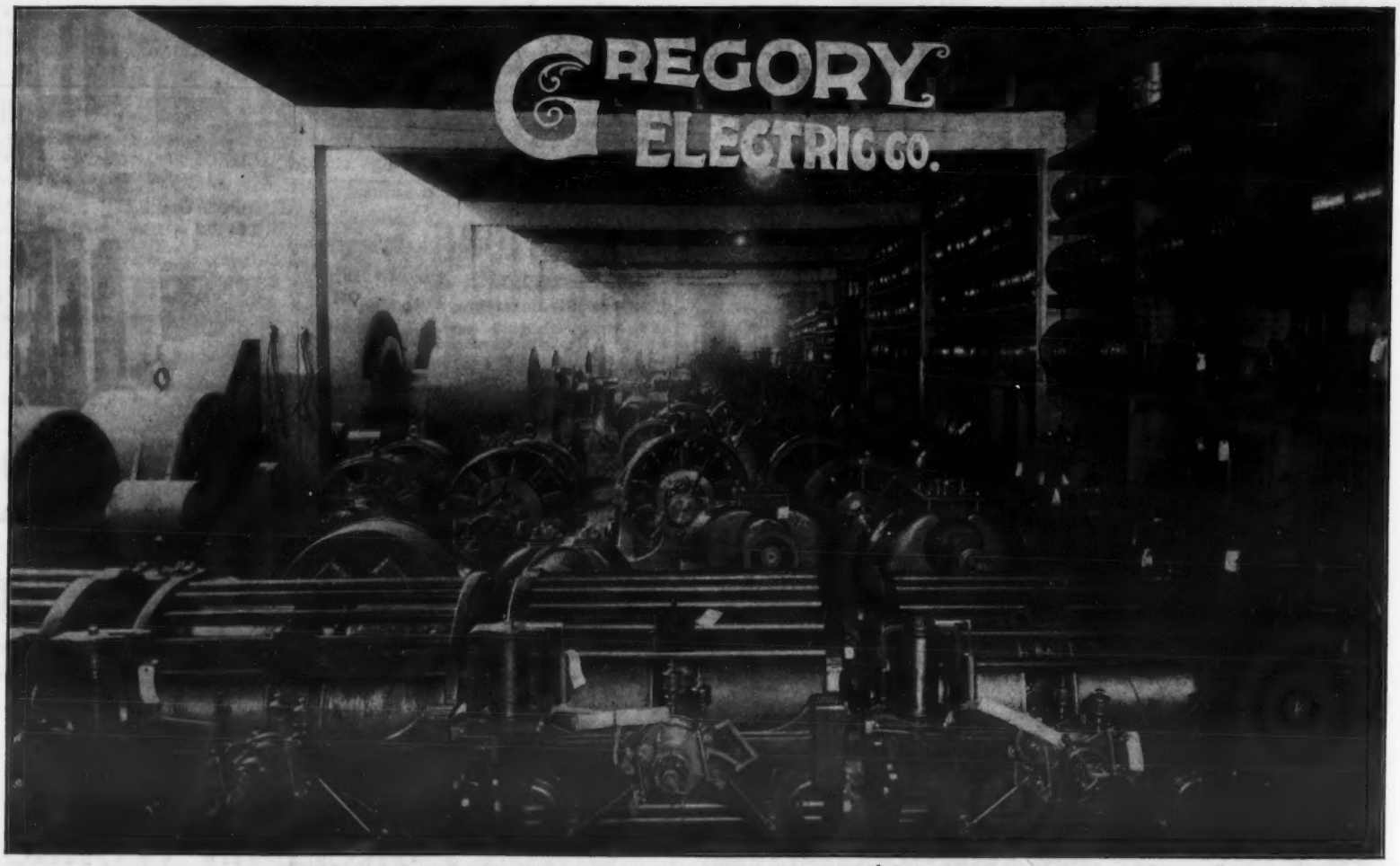

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1 525-kw Westinghouse, two-phase, 2200 volts, 72 alternations, speed 257 r. p. m.
2 240-kw Stanley, two-phase, 380 r. p. m., with engines direct-connected.
2 300-kw Westinghouse, single phase, toothed armatures.
1 220-235-kw Westinghouse, single phase, 1100 volts, 450 r. p. m., 7200 alternations.
1 250-kw Westinghouse, two-phase, 1100 volts, 450 r. p. m., 7200 alternations.
1 150-kw Westinghouse, two-phase, 1100 volts, 600 r. p. m., 7200 alternations.
2 A-120 General Electric, single phase, 1000 volts, 16,000 alternations.
2 90-kw Gen. Elec., single phase, 1000 volts, 16,000 alternations.
2 120 Westinghouse, single phase, 1100 volts, 16,000 alternations.
1 75-kw General Electric, two-phase, 2300 volts, 60 cycles.
2 75-kw monocyclic General Electric, 1050 volts, 7200 alternations, with exciters.
1 60-kw General Electric, single phase, 2000 volts, 16,000 alternations.
1 60-kw Westinghouse, two-phase, 2200 volts, 60 cycles.
1 45-kw Westinghouse, 2200 volts, 16,000 alternations.
1 150-kw Fort Wayne, 2200 or 1100 volts, 16,000 alternations.
2 75-kw Fort Wayne, 2200 or 1100 volts 16,000 alternations.
2 75-kw Stanley, 2400 volts, two-phase, 16,000 alternations.
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2 100-kw units, consisting of one straight line engine and two 50-kw General Electric, 6-pole generators, one on either side of the engine, 250 r. p. m.
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2 150-kw Edison Bipolar.
4 100-kw " "
4 60-kw " "
4 45-kw " "
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4 25-kw " "
2 20-kw " "
2 15-kw " "
2 10-kw " "
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1 25-kw Electro Dynamic.
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1 45-kw Westinghouse, M.P., 850 r. p. m.

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1 75-kw General Electric, direct-connected to Ideal engine.
1 80-kw Churchward, direct-connected to Russell engine.

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1 100-kw Edison.
1 80-kw Siemens & Halske.
1 45-kw General Electric, M.P., 800 r. p. m.
1 35-hp U. S., 775 r. p. m.
1 15-hp Westinghouse, M.P.

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1 25-hp Keystone.
1 25-hp M.P. Eddy.
1 20-hp M.P. Westinghouse.
1 15-hp M.P. Eddy.
1 15-hp M.P. General Electric.
1 10-hp Eddy.
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1 26 " Perett.
1 50 " Hawkeye.
1 50 " Card, self-oiler.
1 50 " Nowotny, self-oiler.
1 50 " C & C, self-oiler.
1 55 " Edison, 3 K.W., s. o., comp.
1 50 " Mather.
1 60 " T.-H., 75 volts, comp., with extra armature.
1 75 " Thomson-Houston, D5.
1 75 " Wood, self-oiler.
1 90 " Westinghouse.
1 100 " Cutten.
1 100 " Jenney, comp.
1 210 " Triumph, self-oiler.
1 225 " United States.
1 250 " Westinghouse, horiz. type.
1 250 " Commercial, comp., self-oiler.
1 270 " T.-H., comp., self-oiler, D15.
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1 300 " Columbian, M.P., comp., s. o.
1 340 " Eddy, self-oiler, compound.
2 350 " Hawkeye, comp. wound.
1 350 " National, self-oiler, compound.
1 350 " Edison, 20 K.W., shunt.
3 350 " Edison, 20 K.W., self-oilers.
1 350 " Edison, 20 K.W., self-oiler, compound.
1 360 " Duplex, M.P., self-oiler, compound, slow speed.
1 400 " Wood, M.P., s. o., 25 K.W.
1 450 " Edison, 25 K.W., self-oiler.
1 450 " Rockford, self-oiler.
1 540 " Edison, 30 K.W.
4 540 " Edison, 30 K.W., s. o.
4 540 " Edison, 30 K.W., self-oilers, compound.
1 600 " Eickmeyer.
1 700 " Siemens & Halske, 40 K. W., multipolar, slow speed.
2 700 " Westinghouse, 10-pole, slow speed, 40 K.W., s. o., new.
4 800 " Edison, 45 K. W., self-oilers.
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1 10 " Lundell, s. o., M.P., s. s.
1 12 " Eddy, s. o., new arm't.
1 15 " Edison, compound, self-oiler.
1 25 " Edison, self-oiler.
1 40 " E. & C., M.P., slow speed.

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2 15 K.W. Edison, self-oilers.
1 15 " T.-H., self-oiler.
1 25 " T.-H., s. o., D25, compound.
1 25 " Edison, self-oiler.
1 30 " Jenney, self-oiler.
1 35 " Jenney, s. o., compound.
1 35 " Mather, self-oiler.
3 45 " Edison, compound, self-oilers.
1 75 K.W. Westinghouse, Kodak set Westinghouse generator and Westinghouse comp. engine 14x24x14 all complete, fine.
1 150 " Detroit (Rae), M.P., compound, s. o., new armature.

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1 600-light T.-H., A6, self-exciting, 15,000 alt., 1100 volts.
2 600 " T.-H., A6, 30 K.W., 15,000 alt., 1100 volts, s. o., with exciter.
1 600 " T.-H., 30 K.W., 2-phase, 1100 v., 15,000 alt., with exciter.
1 600 " T.-H., 30 K.W., slotted arm't, compound, s. o., 1100 v., 15,000 alt., complete, with exciter.
2 650-light T.-H., A35, s. o., 15,000 alt., 1100 v., composite wound, with exciter.
2 750 " Westinghouse, 37½ K.W., 16,000 alt., oil cups, with good armature, 1100 volts.
With new armature, 1100 v.
With new armature, 2200 v.
Exciter extra.
2 750 " Westinghouse, 16,000 alt., s. o., 37½ K.W., with good armature, 1100 volts.
With new armature, 1100 v.
With new armature, 2200 v.
Exciter extra.
1 1000 " Wood, 50 K.W., s. o., 16,800 alt., 1100 v., toothed arm't, latest type, comp. wound, complete with exciter.
1 1200 " Westinghouse, 60 K.W., reconstructed type, s. o., toothed arm't, 16,000 alt., 1100 v., complete with exciter.
1 1200 " Westinghouse, 60 K.W., reconstructed type, s. o., compound toothed arm't, 16,000 alt., 2200 v., complete with exciter.
1 1200 " G. E. A60, 1100 or 2200 volts, 15,000 alt., comp. wound, toothed arm't, s. o., complete with exciter.
2 1300 " T.-H., A70, 1100 v., 15,000 alt., s. o., compound wound, complete with exciter (delivery Sept. 1).

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1 6000 " Westinghouse, 300 K. W., 2200 volts, 16,000 alt., latest type toothed arm't, comp. wound, s. o., three bearings, without exciter.

ARC DYNAMOS.

1 20-light 2000 C.P. Western Electric.
1 30 " 2000 " West. Electric, s. o.
1 30 " 2000 " Brush, No. 7, with latest improved Steubenrausch commutator.
2 35 " 2000 " T.-H., LD2.
1 35 " 2000 " T.-H., ring armature.
1 40 " 2000 " Wood, No. 7.
2 40 " 2000 " West. Electric, s. o.
1 45 " 1200 " T.-H., M12, ball arm.
2 45 " 1200 " Brush, No. 7, with latest improved Steubenrausch commutator.
1 50 " 1200 " T.-H., LD12, ball armature.
1 50 " 2000 " T.-H., MD2, s. o., ring armature.
1 50 " 2000 " Brush, No. 7½.
2 60 " 2000 " West. Electric, s. o.
1 60 " 2000 " Westinghouse, toothed arm't, 6-pole, direct current, s. o., complete with exciter.
2 60 " 2000 " Wood, No. 8.
1 65 " 2000 " Brush, No. 8, new arm't, extra fine, with latest improved Steubenrausch fireproof commutators.
2 75 " 1200 " Wood.
2 75 " 1200 " Standard.
2 75 " 1200 " Standard, s. o., air-insulated commutator, complete with regulator.
2 75 " 2000 " Westinghouse, s. o., toothed arm't, direct current, 6 poles, complete with exciter.
3 125 " 1200 " Excelsior, latest type, s. o., fine.

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MOTORS, complete with base frame, pulley, new brushes, and automatic release starting box:
1 Singer, ½ H.P., 220-volt.
1 LaRoche, 1 H.P., 220-volt.
1 Mather, 1 H.P., 220-volt.
1 LaRoche, 1 H.P., 220-volt.
1 Commonwealth, 2 H.P., 500-volt.
1 C & C, 5 H.P., 500 volt.
1 Bilberg, 7½ H.P., 500-volt.
1 T.-H., 10 H.P., 220-volt.
1 Eddy, 20 H.P., 110-volt.
1 United States, 20 H.P., 220-volt.
1 Lundell, 2 H.P., 220-volt.
1 Holtzer-Cabot, ½ H.P., 220-volt.
1 Westinghouse, 5 H.P., 220-volt.
1 Westinghouse, 7½ H.P., 220-volt.
1 Sprague, 3 H.P., 220-volt.
3 Sprague, 5 H.P., 220-volt.
1 Sprague, 1 H.P., 220-volt.
1 Lundell, 2 H.P., 220-volt.
1 Edison, 1 H.P., 110-volt.
1 C & C, 2 H.P., 220-volt.
1 Keator, 3 H.P., 220-volt.
1 Thomson-Houston, 2 H.P., 220-volt.
1 Edison, 12 H.P., 110-volt.
1 16 K.W. M.P. Maine, 220-volt.
2 Westinghouse No. 3, 30 H.P., 220-volt.
1 20 H.P. Edison, 110-volt.
2 30 H.P. Edison, 110-volt.
1 Belnap, 10 H.P. M.P., 110-volt.
1 10 H.P. Excelsior, single-phase, 7200 alternations, 110-volt.
1 5 H.P. Fort Wayne, 16,000 alternations, 200-volt.

ARC LAMPS: 500 new enclosed arc lamps, latest type, brass oxidized finish, complete with glassware, price $9.75 each.
Large lot of K and M improved T.-H. arc lamps at bargain prices.

ALTERNATORS: Single-phase, 16,000 alternations, complete with exciter and instruments:
1 600-light Royal.
2 30 K.W. Westinghouse.
2 A30 K.W. T.-H.
4 A35 K.W. T.-H.
1 650-light National.
2 A60 K.W. T.-H.
2 A120 K.W. T.-H.
2 A100 K.W. G. E.
1 A240 K.W. G. E.
2 120 K.W. Westinghouse.
2 75 K.W. Westinghouse.

ALTERNATORS, TWO-PHASE.
1 60 K.W. Stanley.
2 75 K.W. Westinghouse.
2 150 K.W. Stanley.

RAILWAY GENERATOR, complete with base frame, pulley, field rheostat and new brushes:
1 45 K.W. Edison.
2 60 K.W. Edison.
3 100 K.W. Edison.
3 D62 T.-H.
1 75 K.W., M.P., T.-H.
1 90 K.W., M.P., T.-H.
1 150 K.W. Walker.
1 175 K.W. Brush.
1 250 K.W. Westinghouse.

RAILWAY MOTORS: 10 equipments of G. E. 800, 3-turn, complete with controllers, resistances, cables, etc.
10 G. E. 628, new.
10 G. E. 57s.
12 G. E. 1000.
12 Walker, 25 H.P.
10 Steel motors, 25 H.P.

RAILROAD TRUCKS.
12 Brill's No. 21, 6′ 6″ wheel base.
12 Peckham 7B, 6′ 6″ and 7′ 6″ wheel base, standard gauge.

ARC DYNAMOS, complete with base frame, pulley regulator, and new brushes with each machine.
3 30-light 2000-cp T.-H.
2 30-light, 2000-cp Brush.
2 35-light, 2000-cp T.-H.
2 40-light, 2000-cp Fort Wayne.
2 50-light, 2000-cp Fort Wayne.
1 40-light, 2000-cp Western Electric.
3 45-light, 1200-cp T.-H.
1 50-light, 2000-cp Excelsior.
7 50-light, 1200-cp T.-H., M.D.
5 50-light, 2000-cp T.-H., M.D.
1 80-light, 2000-cp Brush.
2 75-light, 2000-cp Fort Wayne, Wood.

ENGINES.
1 15 3-16x16 Ball.
1 16x16 automatic centre crank Ball.
1 18x48 Atlas Corliss.
1 13x20x14 Ideal tandem compound.
1 13x20x15 Dick & Church, tandem compound.
1 14x18 Russell automatic.
1 10x12 Valley Iron Works.
1 8x10 Payne automatic.
1 13x12 Armington & Sims.
1 9x12 Armington & Sims.
1 8x10 Armington & Sims.
1 11x12 New York Safety.
1 14x14 Ideal.
1 9x15x9 Westinghouse compound.
1 10 H.P. Westinghouse, Jr.
1 15 H.P. Westinghouse, Jr.
1 250 H.P. Westinghouse compound.
1 250 H. P. Marine type stationary engine, manufactured by the Lake Erie Engineering Works, Buffalo, N. Y., of the vertical cross compound direct connected type; cylinders 14x28x24, running at 150 revolutions; fitted with suitable 9′ balance wheel, having an extended shaft and outboard pedestal suitable for taking a 200 K.W. General Electric Generator, complete with independent jet condenser, and 300 H.P. Wainwright heater.
1 36x36 American Shipbuilding Co.'s vertical Marine type of stationary engine, with condenser.

DIRECT CONNECTED DYNAMOS AND ENGINES.
1 5 K.W. Eddy, and Case engine, 125-volt.
1 25 K.W. Eddy, and Russell engine, 220-volt.

TRANSFORMERS.
Large lot of T.-H, Type F, Oil Transformers, Stanley Transformers and Westinghouse Transformers, in the regular type sizes and varieties.

Large lot of Whitney alternating brass case ammeters for 7200 and 16,000 alternations, in 15 to 250 amperes capacity.

EXTRA ARMATURES.
1 A35 T.-H. Alternator.
1 15 K.W. Edison, 125-volt.
1 25 K.W. Edison, 125-volt.
1 20 H.P., 220-volt, Sprague.

SHALLENBERGER METERS — WESTINGHOUSE. (60 or 133 Cycles.)
57 20-ampere.
50 50-ampere.
2 80-ampere.

110 AND 220-VOLT GENERATORS.
1 10 K.W. Edison, 110-volt.
1 15 " " "
1 25 " " "
2 30 " " "
2 45 " " "
1 60 " " "
1 D50 T.-H., 125-volt.
1 80 K.W. Wenstrom, 125-volt.
1 30 K.W. Western Electric, 220-volt.
2 50 K.W. Western Electric, 220-volt.
1 50 K.W. Triumph M.P., 220-volt.
4 200 K.W. 220-volt Walker, M.P.
1 40 K.W. Eddy, 220-volt.
1 30 K.W. Card M.P., 110-volt.
1 30 K.W. Card M.P., 220-volt.
1 30 K.W. Card, 500-volt.
1 25 K.W. Card M.P., 110-volt.
1 25 K.W. Edison, 40-volt.

HORIZONTAL RETURN TUBULAR BOILERS, complete with fronts and fittings:
2 60x16.
8 66x16.
2 64x14.
2 48x16.
3 48x14.
1 56x14.
1 54x15.
3 63x16.
2 150 H.P. Babcock & Wilcox water-tube.

We are buying outright for cash all kinds of Dynamos, Motors, Arc Lamps, Transformers, Engines and Boilers. Send us a complete list of what you have for sale and get our offer.
All our Dynamos and Electrical Apparatus have been completely overhauled and thoroughly refitted, and are guaranteed free from any inherent electrical or mechanical defects.
Correspond with us on anything you have to sell or anything you wish to purchase in our line. Complete specifications furnished for any material wanted.
Full line of cars, railroad equipment.

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FOR SALE

INTERESTING PRICES AND QUICK DELIVERY.

ALTERNATORS.
1-120 K.W. West'ghouse.
2-120 " Gen. Elec.
1-100 " Gen. Elec.
1- 60 " Stanley.
1- 60 " Gen. Elec.
1- 50 " Ft. Wayne.
1- 50 " West'ghouse.
1- 45 " West'ghouse.
2- 37 " West'ghouse.
1- 35 " T.-H.
1- 30 " Gen. Elec.
1- 30 " West'ghouse.

ARC DYNAMOS.
2-160 Lt. Brush.
2- 80 " Brush.
4- 60 " Brush.
2- 50 " Wood.
1- 50 " T.-H.
1- 35 " T.-H.
1- 30 " T.-H.

ENGINES.
1-250 H.P. Wheelock.
1-200 " McI. & S.
1-175 " Ideal.
1-150 " Ball.
1-150 " Russell.
3-125 " Ball.
1-100 " Payne.
1-100 " Ball.
1- 80 " Ideal.
1- 75 " A. & S.
1- 65 " N. Y. Safety.
1- 60 " Ball.
1- 50 " West'ghouse.

Write us about Dynamos, Motors, Engines, Boilers, etc., to buy or sell.

MAYO & ROHRER CO.,
220 BROADWAY, NEW YORK.

FOR SALE.

LOW PRICES. QUICK DELIVERY.

MOTORS.
1 H.P. 220 v. Sprague.
1 " 220 v. Lundell.
1 " 110 v. Eddy.
1 " 220 v. C & C.
1 " 500 v. Detroit.
2 " 110 v. Eddy.
3 " 220 v. Mayer.
3 " 220 v. Sprague.
3 " 220 v. Diehl Type H.
2-5 " 220 v. Diehl Type H.
7½ " 110 v. C & C.
3-12 " 110 v. Elec. Dyn.
10 " 220 v. T. H.
7 " 110 v. Elec. Dyn.
20 " 220 v. C & C.
10 " 500 v. "
15 " 220 v. "
7½ " 220 v. Edison.

DYNAMOS.
30-light West.
35 " T. H.
100 " West. Elec.
2-160 " Elec. Dyn.
2-300 " U. S.
450 " Onondaga.
15 K.W. Detroit.
20 " T. H.
2-45 " West M.P. almost new.
2-85 " Wenstrom.
100 " West, 6-pole.
1-100 " G. E.
1-120 " West.
45-light T. H. arc, circular armature.

ENGINES AND BOILERS.
60 H.P. Ames engine.
135 " Armington & Sims.
150 " " "
150 " Vertical boiler.
2-66x16 H. T. boilers.
2-60x16 " "

Large stock of ELECTRIC FANS, all voltages, new and second-hand; also TRANSFORMERS.

H. J. LINDER & CO.,
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REPAIR SHOPS.

76 MARKET STREET, CHICAGO. TELEPHONE, MAIN 1280.

First-Class Equipment in all Shops.

OPEN DAY AND NIGHT. PROMPT ATTENTION.

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MANUFACTURERS

Standard Arc Lamps for all Circuits.

New and Second-Hand Machinery and Supplies. Armature Winding and Repair Work.

ELECTRIC LIGHT PLANT—MUST BE SOLD QUICK.

Modern installation, three and four years old, consisting of two (2) 13″ and 22″ x 13″ Westinghouse Compound Engines, and two (2) Westinghouse, 60-kw, Alternating Dynamos, 16,000 alternations, 133 cycles, speed 800 and 900 revs., respectively. Complete with exciters, full set of station instruments and 32 incandescent arc lamps.
Also a large stock of Dynamos and Motors, Automatic Engines, Ball, Ames and Armington & Sims, and Corliss Engines up to 500 horse-power. Also Boilers.

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SEATTLE:
Selling Department,
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Supplement to Electrical World and Engineer, September, 1, 1900.

ELECTRIC LIGHT AND POWER NEWS.

NEW CASTLE, PA., proposes to invest in a municipal electric light plant.

LEESVILLE, LA.—It is stated than an electric lighting plant will be built here.

RIVER FALLS, WIS.—A municipal lighting plant, with water power, is to be put in.

CHATTANOOGA, TENN.—The New Southern Hotel will install an electric light plant.

BIWABIK, MINN., has placed $7,000 bonds in order to build a municipal lighting plant.

DEADWOOD, S. D.—The Black Hills Electric Light Company needs construction material.

BIRMINGHAM, ALA.—The Irondale Water, Light & Power Company will build a steel power house.

ADEL, IOWA.—The Adel Mill Company is installing electrical apparatus. V. W. Hancock is president.

DUBLIN, GA., proposes to put in a small arc and incandescent lighting plant of about 75 to 100 horse-power.

SEARCY, ALA.—A franchise for an electric light plant has been granted to S E. Drinkwater, of Memphis, Tenn.

BERGEN, N. Y.—A 25 years' franchise has been granted to Mr. O. R. Bissell, of Cleveland, who will put in a plant.

WEST PLAINS, MO., will issue $27,500 bonds to cover the purchase of an electric lighting plant and water works.

DAYTON, KY.—The Dayton Electric Light & Power Company has received bids for the erection of a $25,000 plant.

FAIR HAVEN, VT.—The Fair Haven Electric Company, A. Tuttle, treasurer, reports a fair outlook for business.

BELLEFONTE, PA.—The Bellefonte Electric Company, of Bellefonte, has been incorporated with a capital of $1,000.

STATESVILLE, N. C.—The Statesville Electric Light Company will install additional machinery for enlarging its plant.

NEOGA, ILL., is in the market for a municipal plant of 25 arcs of 2000 candle-power and about 800 16-cp incandescents.

ST. CLAIRSVILLE, ILL.—The St. Clairsville Electric Light plant will in the near future change its arc lighting system.

MOLINE, ILL.—The People's Power Company, of Moline, has certified to an increase in capital stock from $300,000 to $600,000.

WEST PLAINS, MO.—It has been decided by popular vote to issue $27,500 of bonds for a water works and electric light plant.

STRATFORD, ONT.—The Stratford Gas Company, John Read, manager, reports the outlook for electrical business there as bright.

JEFFERSON CITY, MO.—The Rankin Electric Light & Power Company, of Tarkio, has increased its capital from $10,000 to $25,000.

COLUMBUS, OHIO.—The Citizens' Electric Light & Power Company, of Sandusky, has been incorporated with a capital of $100,000.

MARENGO, IOWA.—The Marengo Electric Light & Power Company, J. H. Branch, president, reports fair prospects for the fall season.

MILWAUKEE, WIS.—The Milwaukee Electric Company has secured a renewal of the city lighting contract for a period of five years.

MEMPHIS, TENN.—The Memphis Hotel Company, putting up a large new hotel, is in the market for an electric light plant, elevators, etc.

INDIANAPOLIS, IND.—Ground has been broken for a new electric power plant to be erected in this city to accommodate manufacturers.

BOULDER, COLO.—J. C. Mason, superintendent of the Boulder Electric Light Company, states that he needs a few house supplies.

ANNISTON, ALA.—The Anniston Manufacturing Company has contracted for the installation of an electric lighting plant in its cotton mill.

GEORGETOWN, KY.—R. W. Nelson, mayor of Newport, Ky., has purchased the Georgetown water works and electric light plant for $30,000.

FLORENCE, ALA.—E. J. O'Beirne, of Birmingham, Ala., has made a proposition to the city of Florence to establish an electric light plant.

BELAIR, MD.—The Belair Electric Company, Milton A. Reckord, manager, is in the market for engine, boiler and a 2000-volt alternator.

WRIGHTSVILLE, GA.—The city has voted in favor of the proposed issuance of $15,000 for erecting an electric light plant and water works.

WAUPACA, WIS.—President Irving P. Lord, of the Waupaca Electric Light & Railway Company, reports the prospects for the fall season as good.

THE ZANESVILLE LIGHT & POWER COMPANY, of New York City, has been incorporated at Dover, Del., with a capital stock of $225,000.

OLIVIA, MINN.—The Triumph Electric Company has been awarded a contract by the town of Olivia, for $3,197, for an electric lighting plant.

BEARDSTOWN, ILL.—Secretary W. E. McCullough, of the Beardstown Electric Light & Power Company, reports business for the fall as good.

LAUREL, MD.—The city will purchase the lighting plant of the Laurel Electric Company and operate it in connection with its proposed water works.

LANCASTER, S. C.—The power for the new million-dollar Lancaster Cotton Mills will be electrical, and will be furnished by an independent company.

AIKEN, S. C.—The Carolina Light & Power Company has increased its capital stock from $30,000 to $50,000, for the purpose of enlarging its plant.

MECHANICSVILLE, N. Y.—Mr. F. S. Clute reports that the Half-Moon Light, Heat & Power Company has ordered a 150-kw three-phase alternator.

SNOQUALMIE FALLS, WASH.—The Snoqualmie Falls Power Company is increasing its hydraulic plant at its electric power station, Snoqualmie Falls.

DUNKIRK, IND.—The Consolidated Water & Light Company, Chicago, has a contract for an electric lighting and water works plant to cost about $35,000.

EVANSVILLE, IND.—The City Council has refused to levy a special tax for an electric light plant, and $13,000 already collected has gone into the general fund.

OSAGE, IOWA.—The Osage Electric Light, Heat & Power Company regards the outlook as fair. It is not adding to its plant and is only buying ordinary supplies.

POUGHKEEPSIE, N. Y.—The Poughkeepsie Electric Light Company has received a five-years' contract for street lighting at $89 per arc, partial moonlight schedule.

GOLDEN, COLO.—The Golden Illuminating Company will begin a day circuit on Sept. 1, and needs 220-volt motors. Mr. M. Morrill is president and manager.

SPENCER, IOWA, is in the market for a 70-kw 1000-volt alternator, slow speed. Mr. F. Kellogg is superintendent, and has been purchasing supplies and apparatus.

NEW IBERIA, LA.—The city has let the contract to M. T. Lewman & Co., of Louisville, Ky., at $89,900 for the construction of its water works and electric light plant.

ALMA, MICH.—Mr. L. A. Sharp, of the Alma Electric Light & Power Company, says it is not making any extensions, but "expects to continue to make ends meet."

BRITT, IOWA.—The Britt Light & Power Company has been incorporated. Capital, $12,000. Incorporators: R. H. Walker, A. J. Ashby, L. M. Goodman, all of Britt.

FAYETTEVILLE, N. C.—The president of the Lafayette Knitting Mills, Fayetteville, has visited the northern markets to select an electric lighting plant for the mills.

EAST CLEVELAND, OHIO.—This village is taking steps to improve its water service. It is proposed to erect a new reservoir, the pumps to be operated by electricity.

MECHANIC FALLS, ME.—Mr. H. T. Sands writes us: "There is quite a lot of new lighting business in sight, but as yet we have not been able to secure any power service."

MONROEVILLE, OHIO.—The village trustees have passed a proposition to erect a municipal electric lighting and water plant. The estimated cost of the plant is $18,000.

POCOMOKE CITY, MD.—Mr. R. M. Stevenson is manager of the Citizens' Power & Light Company, of this place. The company may make extensions to its plant before long.

YPSILANTI, MICH.—The Washtenaw Electric Company, of which Mr. R. W. Hemphill, Jr., is manager, is building a new plant, and will soon be ready to serve its customers.

NEW IBERIA, LA.—A contract for a new lighting plant and water works has been awarded to M. T. Lewman & Co., for $89,920. The consulting engineer is Mr. T. W. Nicol.

CLAY CITY, IND.—The Clay City Electric Light Company regards the outlook as reasonably favorable, but is not at present in the market for any increase of apparatus.

BEEVILLE, TEX.—The Beeville Light Company has been incorporated. Capital ,$10,000. Incorporators: P. H. Swearengin, Benjamin Dubinski, S. J. Brooks, all of San Antonio.

OWENSBORO, KY.—The city of Owensboro is to build an electric light plant for municipal service. The contract for the power house has been awarded to W. F. Stere at $7,486.

GRAFTON, N. D.—D. A. Willard, electrician for the city of Grafton, reports that owing to the failure of the crops, no extensions to the lighting plant will be made this year.

OXFORD, IOWA.—The town of Wyoming has granted a franchise to J. R. Binn & Sons, who will probably put up a plant at the Wapsie River, six miles south, at Oxford Mills.

ELLSWORTH, KAN.—The Ellsworth Electric Light Company is in a prosperous condition. Mr. C. F. Pohlman, the manager, looks into the future for his business with much hope.

WINCHESTER, TENN.—Mr. C. F. Gattis is in the market for an electric light plant, including turbine and dynamo, 800 incandescent lamps of 32 candle power and insulated wire.

ANTIGO, WIS.—Mr. W. L. Elliott says: "With me business looks good," and states that he has just put in a pair of 55-kw machines. He has 380-hp of Russell engines and two boilers.

OXFORD MILLS, IOWA.—An issue of $25,000 in bonds is to be made by the city for electric light plant and sewerage. This plant will probably furnish current to the University of Mississippi.

MACEDON, N. Y.—The Bickford & Kauffman Company will put in an isolated plant for lighting its factory this fall. Ernest W. Brown, of Macedon, will do the work of installing.

GEORGETOWN, KY.—The Georgetown water works and electric light plant were sold at auction recently. Col. R. W. Nelson, Mayor of Newport, was the purchaser, paying $30,000.

KANSAS, ILL.—The Kansas Electric Light Plant, W. C. Pinnell, manager, is encouraged by the favorable prospects to contemplate the desirablity of adding to its dynamo and engine capacity.

MANTORVILLE, MINN., has granted a 10-year franchise and given a 5-year contract to C. S. Wedge & Sons, who will run an electric light plant in connection with their flour mill.

MANCHESTER, VA.—The Richmond Electric Company has awarded the contract to J. T. Wilson, of Richmond, Va., for the erection of the building for its proposed plant to cost $10,000.

WELLSBURG, WEST VA.—The Wellsburg Electric Light, Heat & Power Company will install additional machinery to increase the capacity of its plant. A 100-hp gas engine will be used.

LE SUEUR, MINN.—Mr. R. H. Bradley, superintendent of the municipal electric lighting and water plant at Le Sueur, reports that the outlook is good for a gradually increasing business.

HOLTON, KAN.—The plant of the Holton Electric Company was rebuilt during the past winter, and Manager W. E. Grant looks for a large increase of business this fall, unless all signs fail.

NAPOLEON, OHIO.—The municipal lighting and water plant at this place was destroyed by fire a few days ago. The loss amounted to about $15,000. The plant will be rebuilt as soon as possible.

ASPINWALL, PA.—The pumping station and the electric light station of the Aspinwall Electric Light Company were destroyed by fire last week. Since then the town has been in total darkness.

ORANGE, N. J.—The contract to light the township for three years was awarded to the People's Light and Power Company for 200 or more 32-cp incandescent lights, at $15.50 each per year.

HUDSON, MASS.—The town of Hudson municipal plant, W. G. Lawrence, manager, reports a present excess of capacity over load, with excellent prospects, however, for a steady increase of business.

ANNISTON, ALA.—The Anniston Manufacturing Company will install an electric plant in its cotton mill. The contract has been awarded for a plant of 350 lights, to cost, including engine, $2,500.

COBOURG, CANADA.—The Cobourg Water & Electric Company, Ltd., has just put in a 75-kw Stanley alternator and a 12 x 20 x 30 compound Wheelock engine. Mr. J. E. Skidmore is superintendent.

WEST POINT, VA.—Mr. E. Wilkinson, president of the West Point Water, Light & Power Company, writes that the company needs an armature for a Class A6 T.-H. 1000-volt dynamo, speed 1500 r. p. m.

HIGHLAND, PARK, ILL.—Mr. J. D. Mersereau, of the Highland Park Electric Company, states that the company intends to increase its plant, but will not make up the plans in regard to same for 30 days.

GRAND RAPIDS, MICH.—Mr. B. Meyer, general superintendent of the city lighting plant, states that he is making an addition of 100 Adams-Bagnall enclosed arcs, and is in the market for line material.

SALEM, ORE.—The Rainier Flume, Water & Electric Light Company has been incorporated. The capital stock is $3,000, the incorporators being Dean Blanchard, S. Benson, J. Silver and W. L. Stacy.

BATH, N. Y.—The Bath Electric & Gas Light Company has been incorporated. Capital, $100,000. Incorporators: N. W. Dalton, M. A. Dalton, J. F. Parkhurst, all of Bath; J. F. Parkhurst, attorney, Bath.

LA PORTE, IND.—The La Porte Electric Company has added to its equipment a 120-kw generator and a 300-hp Allis engine. Mr. J. H. Harding, treasurer and manager, describes the outlook as very good.

GALESBURG, ILL.—The authorities of Galesburg, Ill., have voted for a municipal electric lighting plant to have a capacity of 250 arcs of 2000 candle-power. All the lamps will be used for street lighting.

VALDOSTA, GA.—The Valdosta Electric Light & Power Company has installed a power plant and has contracted for all the apparatus. Manager B. W. Bentley reports a very favorable outlook for business.

MIDDLEBURG, N. Y.—The Middleburg & Schoharie Electric Light, Heat & Power Company has been incorporated. Capital, $40,000. Incorporators: D. D. Frisbie, G. N. Frisbie, D. Beekman, all of Middleburg.

JENNINGS, LA.—The Jennings Electric Light & Power Company, Ltd., started up its plant last June, and is fully equipped. The prospects for fall business, Superintendent H. M. Platt reports, are very good.

GOLDSBORO, N. C.—The Goldsboro Illuminating & Traction Company has purchased the plant of the old Goldsboro Electric Light & Power Company for $7,000. The original cost of the plant was about $28,000.

SOUTH BOSTON, VA.—The Electric Light & Power Company, of South Boston, wants two second-hand generators of 250 kilowatts, direct or alternating, and several motors. Mr. J. H. Mebane is electrical engineer.

LANCASTER, OHIO.—Mr. G. Matt, president of the Lancaster Electric Light Company, reports that conditions there are not very favorable for an increase in the business, there being too much cheap natural gas.

VALLEYFIELD, QUE.—The Valleyfield Electric Company, Ltd., is encouraged by the demand for current to propose increasing its plant by a new arc machine and probably a new incandescent one soon; also a water wheel.

SAN PEDRO, CALIF.—Mr. E. V. Griffis, manager of the United Electric, Gas & Power Company, of this city, looks into the business future with much hope. In his opinion, the outlook for fall and winter business is excellent.

BELLEVUE, PA.—The Ohio Valley Electric Company, D. M. Sloane, secretary, finds the outlook very good for increased business, and proposes to add one new engine and one new incandescent lighting dynamo to its plant.

CHARLESTON, S. C.—Mr. F. K. Carey, of Baltimore, has resigned the presidency of the Charleston Consolidated Gas & Electric Company, and the post has been offered to Mr. S. H. Wilson. Mr. Carey will remain a director.

TOCCOA, GA.—The Toccoa Falls Light & Power Company has been incorporated to develop water and electric power, etc. Capital stock, $50,000. Incorporators: E. P. Simpson, L. A. Simpson, S. V. Davenport and others.

ALBANY, N. Y.—Middleburg and Schoharie Electric Light, Heat and Power Company, of Middleburg, has been incorporated. Capital, $40,000. Directors: Daniel D. Frisbie, G. N. Frisbie and Dow Beekman, Middleburg.

FREDERICKSBURG, VA.—T. McCracken, J. P. Rowe and L. Perry, council committee on light, Fredericksburg, Va., will receive bids until Sept. 18 for building and equipping a street lighting plant of 80 lamps of 2000 candle-power.

SAN DIEGO, CALIF.—The San Diego Gas & Electric Company has recently purchased a 350-hp compound condensing engine for the extension of its plant. The company now needs a 150-light arc machine. Mr. J. W. Jackson is secretary.

ASBURY PARK, N. J.—The Atlantic Coast Electric Light Company has just put in an additional 300-hp engine, 240-kw alternator and a 160-light Brush arc lighter. Mr. W. L. Clark, manager, says the prospects for fall business are good.

BANGOR, ME.—F. D. Oliver, of the Public Works Company, of this city, reports that the outlook in the lighting business in that locality is very favorable. The company's lighting business has been largely increased during the summer.

ST. PETERSBURG, FLA.—The St. Petersburg Electric Light & Power Company is looking forward to a big winter business. During the past five months it has doubled the capacity of its plant. It is in the market for all kinds of supplies.

PRESTON, MINN.—The Preston Electric Light & Water Works need wire for the extension of their electric light service; also pipe, hydrants and valves for the extension of the water service. Address C. M. Morgan, superintendent.

IOLA, KAN.—Bids will be received until Sept. 11 for a plant consisting of 75-hp Corliss engine and corresponding arc lighter. Wire, poles and carbons are also wanted. Mr. W. H. McClure is mayor, and Mr. W. M. Knapp city clerk.

DANVILLE, PA.—The Standard Electric Light Company, has just completed the installation in its plant here of one 125 arc machine, one 60-kw alternator and a 300-hp engine. Supt. G. M. West reports the outlook for business as very fair.

NEWPORT NEWS, VA.—The Consumers' Light, Heat and Ice Company has contracted with the George A. Williams Company, of Jersey City, N. J., for the erection of its proposed electric light plant. The plant will cost about $70,000.

RALEIGH, N. C.—The Raleigh Electric Company, Mr. C. C. Johnson, secretary, reports that business is showing a steady and satisfactory growth and that it is looking forward to a good demand for current during the coming season.

TELLURIDE, COLO.—Mr. C. Y. Breck, superintendent of the Telluride Electric Light & Power Company, states that the outlook for fall and winter business is good. The plant is fully equal to all demands likely to be placed upon it.

COLDWATER, MICH.—Mr. L. A. Dillingham, superintendent of the municipal water works and electric light plant, states that there is no intention of increasing the plant. The outlook is fair and they are reasonably busy with extensions.

EMMETSBURG, IOWA.—The Emmetsburg Electric Light, Heat & Power Company proposes to add a hot water heating system to its existing plant. Mr. John McNamara is proprietor of the business. He reports a fair outlook for business.

FREDERICKSBURG, VA.—The Rappahannock Electric Light & Power Plant is now running 50 arcs and 300 incandescents. It wants to increase its capacity to supply 80 arcs and 600 incandescents. Mr. J. B. Fielden is the general manager.

CHATSWORTH, ILL.—D. J. Stanford, of the Chatsworth Electric Light plant, informs us that this company proposes to install a new boiler. The plant has a capacity of 70 horse-power, and the usual supplies for such a business are required.

SIDELL, ILL.—The Sidell Electric Light, Cold Storage & Ice Company, whose incorporation was recently announced in these columns, is just starting up its business with very flattering prospects. Mr. J. H. Herron is secretary and treasurer.

ORION, ILL.—A contract has been awarded to the Fort Wayne Electric Works, at $5,675, for an electric light plant of 1000 lights of 16 candle-power. This does not include the building. Mr. R. J. Fullerton is chairman of the lighting committee.

IRWIN, PA.—The Irwin Electric Light & Power Company is proposing to increase its plant and will put in two 150-hp tubular boilers, one engine and one 400-kw direct-current generator. Mr. John L. Ridinger, secretary, reports the outlook as good.

CINCINNATI, OHIO.—The electrical department of the Cincinnati Gas Light & Coke Company reports the outlook as bright. It is adding two 400-hp engines and two 4000-light alternators to its equipment. Mr. C. F. Hesser is general manager.

HIGHLAND PARK, ILL.—The Highland Park Electric Light Company proposes to increase its plant and equipment. It is in the market for engine and dynamos. Mr. J. D. Mersereau is the manager, from whom further information may be obtained.

GRAND FORKS, N. D.—The Grand Forks Gas & Electric Company has been making improvements and putting in a steam heating plant. The new apparatus includes additional steam power and a fine marble switchboard. Mr. T. Roycraft is manager.

WEYMOUTH, MASS.—The Weymouth Light & Power Company has added considerably to its system of arcs and alternating incandescents in the past two years. It is now looking for a growth in its motor business. Mr. B. A. Carter is superintendent.

LITCHFIELD, ILL.—The Litchfield Electric Light & Power Company regards the local outlook as uncertain, there being too much municipal ownership talk. This acts naturally as a damper on enterprise and extensions that might otherwise be made.

BELLEVILLE, ILL.—The Belleville Gas Light & Coke Company has just completed extensive improvements to its plant. Superintendent W. E. Steinwedell reports that the outlook in that section is good on account of the St. Louis World's Fair.

TOPEKA, KAN.—The city of Topeka will add a 100 arc light dynamo to its plant. In the way of supplies it needs four miles of No. 6 B. & S wire and windlass fixtures complete for street lighting. N. K. Goodrich is the superintendent of the plant.

SUMPTER, ORE.—The Sumpter Light & Power Company has recently made a large increase in its plant capacity, and is now in a position to meet the fall and winter demand, which promises to be good. Mr. Seymour H. Bell is secretary of the company.

LAWRENCE, KAN.—Mr. R. C. Johnston, secretary of the Lawrence Gas, Fuel & Electric Company, reports that the outlook for fall and winter business in his bailiwick is satisfactory. No improvements or extensions in plant are contemplated at present.

CASSELTON, N. D.—The city of Casselton runs the electric light plant. It is proposed to increase the plant, and an engine and dynamo are needed, besides the usual supplies for an electric light station. For further information, address E. G. Guthrie, auditor.

WINDSOR, VT.—The Windsor Electric Light Company will probably increase its plant; the matter is still in abeyance, however. If it should decide to increase, it will need an incandescent dynamo. Mr. Gilbert A. Davis is the secretary of the company.

ALLIANCE, OHIO, is in the market for an electric lighting plant of about 150 arcs of 2000 candle-power and 3500 incandescent of 16 candle-power. The plant is to cost about $35,000. The apparatus is to be alternating. Mr. O. W. Pfonts is city engineer.

MYSTIC, CONN.—The Mystic Electric & Gas Light Company has just finished doubling the capacity of its plant. It has had a system of over 2000 alternating incandescents. The prospects for business are excellent. Mr. J. B. Smith is superintendent.

SABINA, OHIO.—The Sabina Water & Light plant is to be increased from 50 kilowatts alternating to 100 kilowatts alternating. O. F. Brown, superintendent, writes that a 100-kw alternator is needed in order to carry out the plans for improvement in service.

SAN DIEGO, CAL.—The main dynamo of the San Diego Gas & Electric Company recently burned out, and the assistant engineer, E. W. McCurdy, who was in charge, was found dead near the machine. The city will be in darkness until the machine is replaced.

PENDLETON, ORE.—Manager F. W. Vincent, of the Pendleton Electric Light & Power Company, informs us that it is proposed to increase his plant, and install a 50-kw direct connected dynamo. The future looks favorable in his part of the country, so he reports.

MANCHESTER, N. H.—The Merrimac Heat, Power & Electric Company and the Manchester Electric Light Company, of this city, have been consolidated. The united capitalization is $1,450,000. The name of the resultant concern is the Manchester Electric Company.

SEABRIGHT, N. J.—The Seabright Electric Company is changing from gasoline to steam outfit, with increased output. It will put in engines, boilers, dynamos, etc., and will extend its lines. Mr. C. Heisler, superintendent, describes the outlook as encouraging.

DUBUQUE, IOWA.—Mr. W. J. Brown, of the Home Electric Company, Dubuque, informs that the electrical interests in Dubuque will shortly consolidate, as recently announced in these pages. He says a new station may be built. The outlook for business is very good.

TWO RIVERS, WIS.—The City Council has declared the contract for the water works and electric light plant, which was let to C. A. Iglehardt, of Chicago, null and void, he not complying with the requirements of the ordinance. New bids will immediately be called for.

HAMMONTON, N. J.—The Hammonton Electric Light & Power Company proposes to increase 37½ kilowatts over its present capacity for alternating current lighting. It is buying wiring and construction material. Mr. S. C. Verts, superintendent, reports the outlook as good.

GOLDSBORO, N. C.—The Goldsboro Illuminating & Traction Company, which was incorporated to build an electric light plant, has purchased the property of the present electric light company, increased capacity, and has installed additional machinery. Mr. A. H. Edgerton is secretary.

IOWA FALLS, IOWA.—The Iowa Falls Electric Light & Power Company proposes to extend the Yaryan heating system over seven blocks, and needs pipes, connections, etc. The plant is steadily growing, and the outlook for the future is good, so Secretary H. C. Miller reports.

GEORGETOWN, COLO.—The United Light & Power Company, of this city, is building a new electric light station and power plant of 900 horse-power capacity. All of the needed equipment has been ordered. The business outlook for the future is good. Chas. Newey is secretary.

JOLIETTE, QUE.—The municipal plant of Joliette was renewed two years ago, and is still adequate to the demands on it. Mr. A. L. Carsolais, secretary, etc., says that the only supplies needed from time to time are carbons and incandescent lamps, and wire for new installations.

CHARLESTON, S. C.—At a recent meeting of the City Council a scheme was proposed of bringing water to the city, 30 miles, from the Edisto River, and of establishing an electric lighting plant in connection therewith, both of the systems to be under municipal ownership and control.

SAGINAW, MICH.—The long drawn out contest over the matter of a municipal lighting plant has been disposed of for five years, the Common Council having awarded the Bartlett Illuminating Company a contract for lighting the city from Oct. 1 next, for five years at $65 a light.

WALLA WALLA, WASH.—The Walla Walla Gas & Electric Company contemplates adding to its plant a 300-kw generator. The contract for the machine has been given. "The prospect is for a fair average business; no boom is expected, nor desired," writes Secretary C. E. Burrows.

YORK, PA.—The York Light, Heat & Power Company is proposing to increase its plant by putting in two 200-kw 125-volt generators and a 600-hp Russell engine. Mr. H. E. Rowe, the manager, says that the prospects are very good for a large increase of lighting business this fall.

BURKE, IDAHO.—The Canyon Creek Electric Light Company, Ltd., has just placed an order for supplies. In 90 days, however, it will be in the market for more. The outlook for business was never so favorable, according to the opinion of Mr. W. R. Miller, manager of the company.

ROCHESTER, N. Y.—Mr. G. A. Redman, of the Rochester Gas & Electric Company, reports that the company will make considerable additions to its subway this season. It will be some ten miles in length. Outside of that, there will not be much done to the system in the way of additions.

ALLEGHENY CITY, PA.—The Northern Light, Heat & Power Company has been chartered at Harrisburg, and will at once enter in competition in Allegheny City with the local electric light company. Attorney James Francis Burke, of this city, is the legal representative of the new company.

JANESVILLE, WIS.—The electric company proposes to increase its plant by putting in a 120 to 150-kw three-phase generator and a synchronous motor for long-distance transmission. It is in the market for 3000 lbs. of copper wire. Mr. P. H. Korst, manager, says the prospects are splendid.

FULTON, N. Y.—The Electric Light & Power Company is considering the question of installing a steam plant. The plant is at present run by water power, but during the summer months the water supply is low, and it is to insure reliable power that the company is considering the steam equipment.

GREENWOOD, S. C.—The Greenwood municipal water and electric light plant is comparatively new, having been in operation two years. Mr. A. J. Sproles, superintendent, reports that it cost $45,000, and is already paying expenses and 5 per cent on bonds, with a very low rate for service.

WATSONTOWN, PA.—The borough electric light department of Watsontown has under consideration dispensing with steam, and establishing a water power plant. If this plan should be carried out, it will be in the market for the necessary machinery. Mr. T. H. Kisner is the secretary of the board.

CLEVELAND, OHIO.—The Pelton Engineering Company, Cleveland, has been awarded the contract for an addition to the lighting plant of the Lucas County Infirmary, at Toledo. The installation will consist of a 60-kw 125-volt Eddy generator direct connected to an 85-hp Harrisburg standard engine.

MONROE, LA.—A committee of the council, Messrs. Reily, Downey, Fischer and Cooley, have been appointed to negotiate for the purchase of the plant of the Monroe Electric Light & Water Works Company. Bonds for $60,000 have been voted to make this municipal acquisition, or to put up a new plant.

OMAHA, NEB.—Owing to the frequent fatalities recently, involving the death of linemen and others by electric shock, the city authorities of Omaha and South Omaha have taken steps to have all the electric wires placed underground.

MT. PLEASANT, UTAH.—The Mt. Pleasant Electric Light Company was recently installed and is now operating a 60-kw Warren inductor type alternator. Mr. P. Watson, of the company, is evidently well pleased with its performance, for he says that the company is now all right to make money in the future.

DUNKIRK, IND.—The City Electric Light & Power Company has filed a trust deed with the County Recorder for $23,500 to cover an issue of bonds, the funds to be used in improving and extending the plant. The deed is in favor of the Northern Trust Company and Arthur Heurtley, of Chicago, as trustees.

SAN FRANCISCO, CALIF.—The Copper King Company, Ltd., which is about to build a large smelter at Bay Point, near Martinez, Calif., recently closed a contract with the California Electrical Works for a 200-kw direct current generator. The "Copper King Mine" is controlled by members of the above-named company.

RADFORD, VA.—The Radford Electric Light & Power Company is enlarging its plant, and is receiving bids for two 75-kw alternators, a 100-kw 500-volt direct-current railway generators, turbines to match, and 17 miles of line wire, with lamps and other miscellaneous supplies. Mr. F. S. Pickle is secretary of the company.

PERU, IND.—The City Lighting Company has announced that it had rescinded the proposition made last April, when it agreed to lease the lighting plant, and to turn it over to the municipality at the end of ten years. The company has asked for the return of the written proposition without filing it with the city clerk.

OBERLIN, OHIO.—The Oberlin Gas & Electric Company has no present intention of increasing its plant, but sees good prospects of utilizing its present surplus machine capacity in both arc and incandescent lines. It is now buying general incandescent lighting supplies, wire, etc. Mr. J. W. Beckwith is the superintendent.

CRAWFORDSVILLE, IND.—The municipal lighting plant at Crawfordsville, about whose remarkably cheap operation a good deal has been said, is now being advertised by the city, to be got rid of. Bids are asked for lighting from private companies. The company obtaining the contract is to lease the city plant for a term of years.

PORT HURON, MICH.—The Excelsior Electric Company, of Port Huron, reports a very good outlook for business. It is now adding considerably to its plant. There are now being erected in its power house two 300-kw General Electric three-phase generators, a 1200-hp Russell engine and a 1000-hp Sterling tubular boiler.

TERRELL, TEXAS.—The Terrell Electric Light Company and the Kaufmor Electric Light Company are both under the presidency of Mr. M. A. Joy. The Kaufmor plant is to be increased to double its present capacity, and two direct current 110-volt dynamos will be needed. The business outlook in that section is reported as good.

COVINA, CALIF.—The Covina Electric Company was recently incoroporated for the purpose of generating electricity for light and power purposes. Principal place of business, Covina, Calif. Directors: F. B. Thomas, J. W. Calvert, O. Anderson, H. M. Houser and I. D. Houser, all of Covina. Capital stock, $25,000; subscribed, $500.

WELLSBURG, S. C.—Mr. Thos. J. Ried, secretary and manager of the Wellsburg Electric Light, Heat & Power Company, informs us that his company proposes to increase its plant, and needs a 100 or 125-hp gas engine, 1000-kw alternating current dynamo and 45 enclosed arc lamps. He reports a bright outlook for business.

CARTERSVILLE, GA.—Dr. L. M. Potter, of New York City, has purchased the Etowah iron property for about $500,000. The property includes 17,000 acres of mineral lands, water powers, etc. The water powers are to be developed to generate electricity, which will be transmitted for operating factories and cotton mills to be built.

SAN FRANCISCO, CALIF.—It is reported that there is a probability that an electric railway will be built to connect Napa and Benicia with Vallejo, Cal. The project is contingent upon the granting of a franchise to the Bay Counties Power Company, which has applied for the privilege of extending transmission lines to those localities.

VANKLEEK HILL, ONT.—The Vankleek Hill Electric Company, Ltd., proposes to put in another 100-hp engine shortly, non-compounding, speed 60 to 100 r. p. m., Corliss type preferred. It is in the market for the usual supplies required for wiring, line work, etc. Mr. J. A. Robertson reports the prospects for the winter season as very good.

NORTH ADAMS, MASS.—The North Adams Gas & Electric Light Company is preparing to make an extensive addition to its plant. A 750-hp Fitchburg compound condensing engine will be put in, making a total of four engines with an aggregate capacity of 1800 horse-power. The enlargement of the plant is for the purpose of providing reserve power.

SAN FRANCISCO, CALIF.—The Committee on Public Utilities, San Francisco, recently took favorable action looking toward the adoption of A. E. Brooke Ridley's proposition for lighting the streets and public buildings by electricity. The Eastern capitalists whom he represents desire to install an electric system and sell out to the city in 20 years or less.

CARO, MICH.—The Mutual Lighting Company, of this place, whose incorporation was recently noted in these columns, has been organized. W. J. Gamble is president; G. H. Slocum, vice-president, and W. H. Carson, secretary and treasurer. The apparatus has been purchased, but as yet the company has no station. The company's capital is $10,000.

OTTAWA, ONT.—It is reported that the B. C. gold mines, Summit Camp, British Columbia, has purchased the water-power at Cascade. The power is being developed by the Cascade Water & Light Company. The falls are capable of developing 20,000 horse-power. The principal owners of the B. C. mine are James Ross and C. J. McCuaig, Montreal.

ALBUQUERQUE, N. M.—The Electric Light Company, of Albuquerque, N. M., has ordered one 90-kw, 1500-light, single-phase alternator, 60-cycle, General Electric, to be belted to an Ideal 150-hp engine. The work of installation is under the charge of the company's superintendent, Mr. Ralph B. Coleman, who was formerly with the General Electric Company.

LYONS, N. Y.—Application has been made to Circuit Judge Hazel to have the Clyde Gas & Electric Company, of Clyde, declared an involuntary bankrupt. Argument on the application will be heard at Buffalo on Sept. 4. The corporation went into voluntary dissolution April 7 last. The nominal assets are $71,344.82; the actual, $40,000; liabilities, $50,279.21.

GLOVERSVILLE, N. Y.—The Fulton County Gas & Electric Company is the successor of the Gloversville Electric Company. It is putting in one 225-hp boiler and one 250-hp engine, and it is in the market for a 70-kw alternator. It is making an addition of 35 ft. to the station. The local outlook for sale of current, etc., is good. Mr. John Begley is the superintendent.

HILO, HAWAII.—The Hilo Electric Power & Refrigerator Company, of Hilo, Hawaii, recently closed contracts with the Pelton Water Wheel Company, San Francisco, for two impulse wheels under a head of 400 ft. Each wheel will be direct connected to a Westinghouse generator. An additional Pelton wheel, 18 ft. in diameter, will be direct connected to a Frick ice machine.

CHARLESTON, WEST VA.—The Charleston Gas & Electric Company contemplates putting in a new generator for incandescent lighting and power some time this fall. The electric light is holding its own, and an increase is looked for this winter. Mr. C. H. Hatcher is superintendent. A good deal of natural gas business has been developed by the natural gas company.

ALTON, ILL.—The Alton Railway, Gas & Electric Company is making large extensions to its system. It is enlarging its power house, building new car barns, extending gas works and hot water heating plant, and is now getting estimates on an ice plant. It is always in the market for supplies, but these large improvements will necessarily call for extraordinary quantities.

CANTON, S. D.—The Canton General Electric Company has just added a new boiler to its plant. It needs ordinary supplies. Secretary Chas. E. Judd says that the prospects are that his company will have a large increase of business during the next six or eight months. Several large buildings are to be erected in Canton, and these will necessarily need a great many lights.

POPLAR BLUFF, MO.—The Hartzell Light & Milling Company, formerly the Poplar Bluff Light & Power Company, proposes to increase its plant with a 100-hp Corliss engine, one 800-light alternating current dynamo and one 50-light 1200-cp arc light machine; also countershaft, pulleys, etc. The outlook is very favorable for 50 per cent increase in the business in the next two years.

MARIETTA, GA.—Mr. S. Morgan Smith, of York, Pa., has optioned water power at Bull Sluice, on the Chattahoochee River, with a view of constructing a dam and building an electric power plant to supply 5000 horse-power for lighting and factory purposes at Marietta and Atlanta. The Chattahoochee Electric & Development Company, has, it is said, been organized to complete the project.

SOUTH NORWALK, CONN.—Mr. A. E. Winchester, the energetic superintendent of the South Norwalk municipal plant, states that they are now installing machinery which will double the present capacity of the plant. They are in the market for general operating supplies only. "The outlook is splendid; we cannot meet all the demands for current, and the plant is making lots of money."

SALIDA, COLO.—Mr. C. E. Eggleston, of the Edison Electric Light Company, reports that this is the most prosperous year the company has ever had, and the prospects for the future are bright. The company proposes to increase its water power plant in the near future. It will install a 125-hp boiler and line shafting immediately. Additional dynamo capacity will be required next summer.

TRENTON, N. J.—Mr. Paul Lupke, superintendent of the electrical department of the Trenton Gas & Electric Company, states that the company is at present building a new station which will contain three 800 horse-power units. The foundations for the engines are complete and the boilers and ecnomizers have been set and bricked in. The steel frame of the building is about complete, as is also the stack.

SAN FRANCISCO, CALIF.—The new electric lighting system recently installed by the Wybro-Hendy Company at the United States General Hospital, San Francisco, is ready for operation. There are two complete generating sets having a capacity of 40 kilowatts each. The engines, which are direct connected, were built from Government engineers' specifications by the Ohmen Engine Works, San Francisco.

GEORGETOWN, S. C.—The Georgetown Electric Company is increasing its plant by putting in a 60-kw Warren alternator, 40-hp engine, and a 60 x 16 tubular boiler. All but the boiler has been purchased, but the company is now buying line and house wiring material. Mr. S. C. Ingman, manager, states that the company expects to quadruple its incandescent lighting work and to add six city arcs.

CRISFIELD, MD.—The Crisfield Ice Manufacturing Company has been granted a franchise to put in a system of electric lights. The town also contracted with the company to furnish light at a cost of $1,000. Two arc lights and 152 lights of 32 candle-power will be used for that purpose. The company will begin work at once, and expects to have the plant built and in running order in 60 days.

DUNDEE, N. Y.—The Dundee Electric Light Plant has planned a three-mile extension to Eddytown this fall or next spring. It will need in the future, for the extension, six miles of No. 6 copper wire, step-up transformers and line material. The rights of way have been secured and poles have been set. The company also proposes to install a telephone system between Dundee, Starkey and Eddytown.

CENTRALIA, WIS.—The Twin City Electric Company has in contemplation an increase in its plant. Another unit will be added to the existing equipment for electric power service. The apparatus needed for this extension includes a 200-kw two-phase alternating current 60-cycle dynamo, direct connected to a 300-hp compound engine, and a 150-hp boiler. The future looks good to Manager P. L. Utley.

CRESTED BUTTE, COLO.—The Crested Butte Light & Water Company proposes to increase the capacity of its plant from 500 to 1000 16-cp lights, and will require two 600-light direct current dynamos. It proposes to replace a 3000-ft. 8-in. pipe line with 12-in. pipe, and substitute a 60-in. Pelton wheel for a 48-in. wheel. This work, however, will not be undertaken until 1901. Mr. G. W. Thompson is superintendent.

CUMBERLAND, MD.—The Edison Electric Illuminating Company is making some large improvements in its plant. The boiler plant is to be increased by 300 horse-power; the line is being entirely reconstructed, a new switchboard is to be installed and other improvements are being made. All the equipment has been contracted for and is now being installed. Mr. W. M. Roberts, Jr., is treasurer and general manager.

MILWAUKEE, WIS.—A new company, to control every plant and system in Wisconsin, is said to have been planned by Milwaukee capitalists. The articles were filed with the register of deeds at Milwaukee on Aug. 24. The name of the company is the Wisconsin Traction, Light, Heat and Power Company. Henry C. Payne, John I. Beggs, Charles F. Pfister, and F. G. Bigelow, all of Milwaukee, are the incorporators.

CAMDEN, S. C.—The Camden Water, Light & Ice Company has purchased and is now putting in a 60-kw Warren alternator and a 200-hp Allis Corliss engine, and is putting up 20,000 ft. of line wire. It is now in the market for 35 series enclosed arcs, 6-7 amperes, and transformers from 1000 to 100 volts for 600 lights. Mr. E. E. Mandeville regards the local outlook as splendid, and says that business will double up this fall.

POTSDAM, N. Y.—The Potsdam Electric Light & Power Company proposes an increase of plant to connect with the electric plant of the Hannawa Falls Water Power Company, using 250 kilowatts. The apparatus required is step-down transformers from 4400 volts to 1000 and from 1000 to 110 volts, for 200 kilowatts. The company is in the market for wiring, house supplies, etc. The local outlook for business is excellent.

PITTSFIELD, MASS.—The Pittsfield Electric Company, of this city, is to remodel and increase its plant. The company has voted to purchase a new engine and alternating-current Stanley generator of 375 kilowatts capacity. The engine has been ordered, and the new system will be ready for use by Nov. 15. The new plant will greatly assist the company in filling the demand for power and light, which is rapidly increasing.

MOBILE, ALA.—The Mobile Light & Railroad Company will enlarge its boiler house to 70 ft. x 125 ft. It will also add one 350-hp Babcock & Wilcox boiler, one 16 x 31 x 36 Hamilton Corliss engine, one 250-kw Westinghouse railway generator and one 250 General Electric compensated alternator. All the above apparatus has already been contracted for. The outlook for business for the coming fall is reported as very good.

MADISON, WIS.—The Madison Gas & Electric Company is making a number of improvements in its plant and system. All-night constant direct-current series open arc lamps have been replaced by alternating-current constant-current enclosed arc lamps. The secondary distributing system is being changed from two-wire to three-wire. A 175-kw, 500-volt direct-current unit has been installed and also a 75-kw monocyclic G. E. alternator.

CHATTANOOGA, TENN.—The Chattanooga Light & Power Company expects to put in immediately a new 400-hp compound engine direct connected to a 225-kw alternator and a 250-kw direct current generator. This is needed to take care of a rapidly increasing business, and the company thinks that the demand for light, especially the enclosed alternating-current arc, is going to be good. Mr. Byron T. Burt is superintendent.

LEBANON, ORE.—Mr. J. S. Hughes, manager of the Lebanon Electric Light & Water Company, informs us that his company will in a few months replace the Heisler machine now in use in the plant with another dynamo. He needs a "dynamo that will carry lights two miles with small wire." Among other supplies needed may be mentioned a large amount of water pipe and a large pump. The business outlook he reports as being favorable.

TORONTO, ONT.—Mr. R. J. Parke, consulting engineer, of Toronto, has been engaged by the Municipal Council of St. Mary's, Ont., to prepare plans and specifications for the reorangization and combination of the present municipal arc lighting plant, and the incandescent lighting plant recently acquired by the town from the Reesor Company. A new power station will be erected, and a completely new engine and boiler plant purchased and installed.

ANACONDA, MONT.—Mr. Herbert McNulta, manager of the electric light and railway department of the Anaconda Copper Mining Company, states that the concern is not entertaining any immediate prospect of new work in its electric lighting plant. The outlook for winter lighting is slightly better than that of last year. The company is about to renew three miles of its electric railway, and will add another mile. Work on this operation is to begin immediately.

YORK, PA.—The Susquehanna Electric Power Company will begin work on its $4,000,000 plant at Peach Bottom, York County, about Sept. 1. A large dam, with an immense power house, will be erected on the banks of the Susquehanna River. The plant will generate 40,000 horse-power, of which the United Street Railway Company, of Baltimore, has contracted for 20,000 horse-power for 40 years. The company will also furnish electric light at Baltimore.

ALTOONA, PA.—Mr. E. B. Greene, of the Edison Electric Illuminating Company, of Altoona, Pa., states that that company has arranged to install two 200-kw General Electric dynamos this fall, to take care of the increase in its growing business. The demand on the station for light and power this year has been unprecedented. The company has made extensions to its mains this summer, and expects to add to them again before winter, covering new territory.

MAQUOKETA, IOWA.—The Barnes Electric Light & Power Company, of this place, desires bids for apparatus for the extension of its service. It proposes to start a new 50 to 60 series alternating current arc light service to operate on a 6000-volt three-phase and on a 1000-volt two-phase system, to be divided in two 25 to 30-light circuits so arranged that the load can be changed from one system to the other. Secretary C. F. Goller desires to receive advice on such a system.

KIRKWOOD, MO.—The Kirkwood Board of Aldermen has instructed the committee on electric lights to purchase a lot on which the new municipal lighting plant is to be erected. The property selected is occupied by a new building, built for an ice plant, but never occupied. Bids have been advertised for the sale of city bonds in the amount of $17,000 to supply the funds for building the new plant. Owen Ford, of St. Louis, is engaged in drawing up the plans.

PARKVILLE, S. C.—The Ring Jaw shoals property on the Savannah River, Near Parkville, has been sold to parties who have incorporated the Twin City Power Company for the purpose of developing the water-power and transmitting electricity. It is said that $1,000,000 will be invested. Among the incorporators of the company are Samuel Taylor, New York; W. H. Chew, New York, and D. M. Mackay, New Rochelle, New York. The company's address is 1402 Main Street, Columbia, S. C.

CARLYLE, ILL.—The Carlyle Improvement Company was granted a franchise Aug. 20 to erect and maintain an electric light plant. The plans and specifications of Frank Mackan, of Effingham, Ill., have been accepted. There will be 42 arc lights for street purposes. An engine of 125 horse-power will be used. The entire plant is to be in operation in 60 days. The new company will at once begin the purchase of material and close contracts. The cost of the enterprise is estimated at $8,000.

TACOMA, WASH.—The light and water department of the city of Tacoma proposes to substitute one modern General Electric 1000-kw generator for 600 kilowatts capacity in smaller generators. It also intends to install about 200 enclosed arc lamps. All this plant has been contracted for. The department is in the market for open arc carbons. Mr. O. N. Wiswell, the superintendent of operation and maintenance, says: "The outlook is excellent, and we expect to increase business 50 per cent this fall."

MANDAN, N. D.—Mr. H. R. Lyon is president of a local lighting company which has recently gone into operation, and is doing very nicely. The company buys current from the railway company. It has already a plant worth about $5,000, covering wires, poles, etc. Mr. Lyon, who is president of the First National Bank of Mandan, says that while they raise some wheat in that section, they are, fortunately, not largely dependent upon it, being more heavily interested in stock, cattle, horses and sheep.

CRAWFORDSVILLE, IND.—Municipal street and commercial lighting have been declared a failure after ten years' trial in this city. Council has ordered the plant advertised for lease for a term of ten years. The plant is complete, costing $80,000. The average cost per arc light, counting wear and tear on the machinery, will approximate $100 annually for the 130 lights. Costly repairs are needed, and the city has not the money to make them; hence, it is believed advisable to allow the plant to be operated by private individuals.

YPSILANTI, MICH.—The new plant of the Washtenaw Electric Company, Ypsilanti, R. W. Hemphill, manager, is now complete. It comprises three Samson 56-in. turbines from Leffel & Co., one 450-hp Wright-Corliss engine, one 150-hp Hamilton-Corliss engine, four 125-hp boilers, two 250-kw two-phase Westinghouse generators, a switchboard built by the Wagner Electric Compay, eight transformers of 900-light capacity of Lakon, Wagner, Pittsburg and Packard makes; Sterling poles and Roebling wire. The circuits are carried on Locke insulators.

GLOBE, ARIZ.—The Globe Electric Light & Refining Company will increase its plant for municipal heating. It will install a 50-hp gasoline engine, which, we understand, is yet to be contracted for. Among apparatus and supplies needed are an 18 x 4 x 5 tank and building to cover, corrugated iron, and 1100 sq. ft. of No. 18 galvanized iron. Mr. C. W. Tirch, president and treasurer of the company, reports that there is an unexcelled field there for the extension of the lines and for leaching and refining by electrolysis the copper ores of that district.

SOUTH OMAHA, NEB.—The new Omaha Thomson-Houston Electric Light Company has just closed the purchase of the South Omaha Water Company's electric light plant at South Omaha at a price of $65,000. The company has run new mains from its Omaha station to an elegant fireproof sub-station at South Omaha to transmit current at 5000 volts pressure and transform at the sub-station to 115 volts, and make secondary distribution direct from the sub-station over a radius of one and a half miles of territory. The old plant will eventually be shut down.

LAKEWOOD, OHIO.—This village has placed contracts for a $14,000 extension to its municipal lighting plant. The Westinghouse Electric & Manufacturing Company is furnishing the electric equipment, and the Pelton Engineering Company, Cleveland, the steam plant. The electric equipment will consist of a 150-kw series alternating direct connected generator and 100 series alternating lamps, and the steam equipment of an 18 x 36 Ohio Corliss engine built by Griffeth & Wedge, Zanesville, Ohio, and a 16-ft. x 66-in. tubular boiler. The boiler has not yet been contracted for.

CORUNNA, MICH.—The Shiawassee Light & Power Company contemplates extensive increase in its plant. It needs and will install a pair of 125-hp horizontal turbines under a 10-ft. head, a new or second-hand 75 or 100-kw alternating machine, 1100 or 2200 volts, 60 cycles; about 75-kw in step-up or step-down transformers, 10,000-volt primary, 220-volt, three-wire secondary; also five miles of line wire and equipment complete to operate at 10,000 volts. Forty alternating current series arc lamps are also required. The company has the city lighting contract, and the outlook for business is excellent.

ATCHISON, KAN.—Less than five years ago the Atchison Railway, Light & Power Company had only 350 16-cp lamps in use. The business has now been worked up to nearly 17,000 lights wired on the circuits, which, for a city of 17,000 people, is doing pretty well. Mr. J. A. Bendure, general superintendent, says: "As to our increased lighting business for the fall and winter, I would say that it is in a healthy condition, and that we are wiring new houses as they are building at the present time. We expect a larger consumption of current the coming fall period over that of any previous season."

MADISON, WIS.—Stockholders of the Madison Gas & Electric Company have approved the proposition of the directors to issue $100,000 6 per cent 20-year

debenture bonds. Stockholders will have the privilege of subscribing for these bonds to the extent of $25 for each share of stock of their holdings. It is desired to place the bonds entirely with the stockholders, and in case the full amount should not be subscribed for in this way, the balance will be distributed pro rata on over subscriptions. It is expected that some stockholders will offer to subscribe for considerably more than their pro rata.

WASHINGTON, D. C.—The Navy Department has been informed by the Westinghouse Company, contractors for the great electric power plant which is to be installed in the New York Navy Yard, that the machinery is ready for delivery. The company asks to be absolved from responsibility for any delay incident to its installation in the buildings which the other contractors have not completed yet. The New York Navy Yard will be the first in this country to be fully equipped with electrical driving power for all its machinery and machine tools. The plant will represent an outlay of nearly $1,000,000.

TERRE HAUTE, IND.—The Terre Haute Electric Company is now at work installing new apparatus in its power plant, which is used for both lighting and railway. The company has added two 250-hp Cahall boilers, and is putting in three 300-kw 60-cycle alternators, and one 300-kw 550-volt railway generator, all direct connected to 500-hp Fitchburg Steam Engine Company's engines. The company is expecting great improvement in the service. The company has also just begun building an extension of its railway lines to Brazil, Ind., a distance of 16 miles. Mr. C. B. Kidder is manager.

UTICA, N. Y.—Mr. M. J. Brayton, secretary and treasurer of the Utica Electric Light & Power Company, states that the work of installing the 6000-hp plant which it has had under construction at Trenton Falls during the past year is advancing satisfactorily, and that the company confidently expects to have a portion of the plant completed late this fall or early in the winter. As to the outlook for the fall and winter business, Mr. Brayton says: "The conditions here are very encouraging. The demand for electric light and power is constantly increasing and promises a satisfactory business in the future."

TACOMA, WASH.—Mr. S. Z. Mitchell, of the Tacoma Railway & Power Company, speaks very hopefully of the local lighting outlook, and says: "This section of the United States is now forging ahead very rapidly. While it was at one time decidedly a debtor community, all this has been changed during the past two or three years, and at the present rate it will soon become emphatically a creditor community. The balance of trade is largely in our favor and is increasing all the time. Of course all this means good business, and incidentally there is a marked increase in the demand for electrical goods, current, etc."

DETROIT, MICH.—Mr. Alex. Dow is putting the system of the Edison Electric Illuminating Company, of Detroit, in shape for an active winter. A storage battery equipment is being put in service, the steam piping of one of the stations is being reconstructed and the electrical apparatus in another station is being reorganized. The company has also acquired recently this outside station and is overhauling it. Calls are likely for more current than can well be supplied. Business prospects are thus excellent as to demand, but rates are down to a very narrow margin of profit.

HILLSBORO, ORE.—Mr. H. V. Gates is president and purchasing agent for the following named companies: Klamath Falls Light & Water Company, Elgin Light Company, Castle Rock Electric Company, Hillsboro Electric Light & Water Company, Heppner Light & Water Company and the Prineville Light & Water Company. He informs us that provision has been made to increase all of these plants, the improvements to be completed by Dec. 1. Some ordinary supplies are now needed. Mr. Gates reports that business is good and increasing, and that collections were never so easy. He looks for a continuance of these favorable conditions into next year.

CUMBERLAND, MD.—The Edison Electric Illuminating Company, W. M. Roberts, Jr., general manager, is making considerable improvements. They consist of two 150-hp boilers, in place of two 80-hp taken out; two 100-kw direct-connected General Electric generators, and one 350-hp Buckeye engine. There will also be an entire switchboard, consisting of four generator panels, one total output panel, and one feeder panel. This will be of General Electric make. The company is also putting in an American District Steam Heating Company's heating plant, to use the exhaust steam. About 19,000 pounds of copper will be put up and about three tons of bare wire taken down.

LA CROSSE, WIS.—The City Council is seriously considering the proposition to purchase a municipal electric lighting plant. The time is near at hand when the contract with the La Crosse Brush Lighting Company expires, and the company wants the Council to make another five-year contract at $85 per light, or seven years at $80 per light, but the Council at a recent meeting refused to consider this. The company desires a franchise for that term of years, and if the Council will grant it will place underground wires in the down-town district. The city can purchase its plant at the end of that time if it desires to do so, the price to be fixed by three disinterested parties.

CLEVELAND, OHIO.—The Citizens' Electric Light & Power Company, Sandusky, has been incorporated, with a capital stock of $100,000, by John Sherwin, J. B. Hanna, H. A. Everett, B. Mahler, W. H. Price, George A. Stanley, James Hoge, C. H. Stewart and Charles W. Wasson, all of Cleveland. The company has taken over the property of the Sandusky & Interurban Electric Railway Company, and will extend that line to Lorain to connect with the Lorain & Cleveland Electric Railway, in which several of the same gentlemen are interested. The new company will also furnish light and power for Sandusky. An extensive power house is now in process of construction at Sandusky.

CHICAGO, ILL.—An interesting development is touched on in the following special despatch from Chicago of Aug. 27: There is a hitch in carrying out the purchase of the Ogden Gas and the Cosmopolitan Electric Company, on the part of the People's Gas Company. There is not the slightest prospect of the deal falling through, but there has been delay, due mainly to the inability of the Ogden Company to secure an amended franchise. There has been $200,000 in cash put up as earnest money, and the price fixed for the Ogden Gas and Cosmopolitan Electric was $6,000,000. The Ogden Company has recorded a $6,000,000 mortgage to secure a like issue of bonds, but the bonds have not been issued.

ELECTRIC COMPANY OF AMERICA.—A director of the Electric Company of America says: "Net profits from our regular sources of income for the first six months of 1900 were considerably ahead of the first half of 1899. We had the benefit, however, in that time, of the earnings of two Long Island properties which we do not now own. The proceeds from their sale has not been invested. We are looking at two or three electric lighting properties, but are not in a special hurry to invest the money. We are getting 2 per cent on it as a bank deposit. When we buy a property, we want to see 10 per cent earned on it under its own operation. If it can earn 10 per cent under its present management, it can usually be made to earn more under ours."

PHILADELPHIA.—Mr. A. J. DeCamp, the veteran central station manager, sums up the local situation as follows: "In regard to the outlook for business, I will say that it was never more promising. We anticipated a large increase in business this coming winter, and have been making a great effort to put ourselves in position to meet that demand and have something to spare, but from present appearances, we have underrated rather than overrated the business for this season. Of course, our business is dependent upon the condition of the general business of the city. If we are favored with Republican success the coming fall, there is no doubt in my mind but what we may expect a large and rapid increase in business from that time on."

ALBANY, N. Y.—The next big undertaking of the Empire State Power Company will be the construction of two great storage reservoirs near the headwaters of the Schoharie Creek. Several tracts suitable for the purpose are being examined. It is proposed to award the contracts for the work this fall, so that it may be well under way by spring. According to the estimates of the engineers, it will cost at least $850,000. The company finds that many property owners in the back country are inclined to hold their lands at exorbitant prices, in some cases asking $50 an acre for what is hardly worth more than $5. Then, again, most of the property owners approached demand a revenue for the right to erect transmission poles on their farms. Mr. J. G. Kaelber is president of the company, which will install a large plant of Stanley apparatus.

INDIANAPOLIS, IND.—Mr. C. C. Perry, secretary of the Indianapolis Light & Power Company, reports as follows: "The lighting business in Indianapolis for 1900 shows a reasonable percentage of gain over 1899. The increase in prices of material has curtailed in proportion the ability of managers to extend as rapidly as in former years. Notwithstanding this large additional percentage of cost entering into the construction and maintenance of properties over previous years, I believe the business of 1900 will be satisfactory. The year 1901 can be looked forward to with confidence, unless the unexpected happens. We are now installing a type H 59-plate 156-cell storage battery for our three-wire system. We have added very materially to our alternating distribution and equipment. All things considered, we are satisfied."

ELKHART, IND.—The Home Electric Light & Power Company has passed recently into the hands of a group of New York bankers and capitalists, who propose to put it on a first-class basis both physically and financially. Mr. C. F. Hewitt, treasurer and manager, says: "From my brief experience and observation with lighting affairs here, I should say that prospects are quite bright for a flattering business during the coming fall and winter. Going into detail a little more, I would say we are now having rather a strong demand for alternating-current arc lamps, a demand so general, in fact, that our present capacity is being overtaxed, and we are on the eve of making additions to our power plant and extensions of lines throughout the city, and a general overhauling and partial reconstruction of our distribution system in the more congested portions of the city."

TOLEDO, OHIO.—Mr. E. J. Bechtel, superintendent of the Toledo Consolidated Electric Company, reports: "We have just installed an additional 50,000 ft. duct to our underground system and have yet to draw in and connect $40,000 worth of underground feeders. For the power house we have ordered a new three-phase switchboard and a new three-wire system, and one board; also two 500-kw 125-volt generators for the three-wire system, and one 500-kw three-phase generator. These three generators are to be direct connected to one verticle Allis Corliss engine. The engine and generators were under contract to be delivered next month, but we hardly expect them at that time on account of delays. Our lighting system during the past year has had an unusual growth, and we see no reason why we should not expect the same during the coming year."

BROOKLYN, N. Y.—Continuing his crusade against overhead wires and third rails in Brooklyn, James J. Kirwin, Deputy Commissioner of the Department of Public Buildings, Lighting and Supplies, has sent a notification to the Edison Electric Illuminating Company and other corporations operating in Brooklyn. Mr. Kirwin in this letter directs the companies to inform all linemen in their employ of the danger in the overhead wires. Not long ago the Edison Company notified Commissioner Kirwin that it had informed the different companies maintaining overhead conductors in Brooklyn of the fact that many of the Edison overhead combination lines were carrying high-tension current continuously, day and night. Mr. Kirwin's directions are to consider all the overhead circuits of the Edison Company "alive," and carrying a pressure of not less than 1000 volts.

BOSTON, MASS.—The Edison Electric Illuminating Company, of Boston, is now building a new station which is three times the size of the old Atlantic Avenue station, but built on the same property and adjoining it. It is all one generating plant, while, looked at from the standpoint of safety, etc., it is two separate and distinct plants. This applies not only to the engine room, but to the boiler room, while the switchboard is in a separate brick building by itself. President C. L. Edgar reports that the growth in Boston has been continuous for ten years past. The company is adding each year not only as many lamps, motors, etc., as in the preceding year, but the percentage of increase is actually kept up, and this year it is larger than ordinary. The output in kilowatts sold in the past three or four months has been in excess of 25 per cent gain over the same period last year.

ERIE, PA.—Mr. S. C. Walker, secretary of the Edison Electric Light & Power Company, of Erie, says: "The extensions we have made in our plant during the last six months have been in the way of equipping our boiler plant with a 100-inch blower direct-connected to a 30-hp engine, to apply forced draft under two 350-hp water-tube Gill boilers and two 250-hp water-tube Gill boilers for the purpose of burning No. 2 buckwheat anthracite coal, due to the fact that

soft coal from the Pittsburg district was selling at such a price that it was cheaper to burn anthracite. We have also erected a 2000-ton coal pocket on the P., B. & L. E. R. R., with machinery complete to elevate 600 tons of coal per day of ten hours. We have applied to the city council to provide us with a suitable conduit on the principal street, so as to put our wires underground, but no action has been taken as yet by the city."

AUGUSTA, GA.—The Augusta Railway & Electric Company has just issued $1,000,000 in bonds for the improvement of its lighting and railway plants, etc. Superintendent W. E. Moore says: "We expect a large increase of business for this winter, and we will substitute A. C. constant potential enclosed arc lamps for all of our series open commercial lamps. We will also put into effect a two-rate system of charging for our service, as that system is specially applicable to a plant using water power for generating the current, since in that case the charges varying in proportion to the current sent out are very much less than in the case of a steam power plant, and, as you know, we operate by water power which is purchased from the city at $5.50 per gross horse-power per annum. We are relaying our entire street railway system with 70 to 100-lb. 60-foot rail, and we are also beginning the operation of our first long double-truck cars."

DAYTON, OHIO.—Mr. J. E. Lowes, director of the Dayton & Northern Traction Company, reports as to local development: "As you may well know, Dayton has become a great interurban street railway centre. We now have five interurban railways running into Dayton, three being built and four more being projected that will be constructed during the next year. It is the intention of these roads to build a union traction company depot with a long loop, taking in several blocks of the city. This depot will be made very attractive so as to accommodate both freight and passengers. The Dayton Electric Light Company is now improving its plant, more than doubling its capacity with the most improved machinery, for the purpose of taking care of its largely increased business. The demand for electric current is becoming very great, and the managers of the Electric Light Company believe the business will be increased at least one-third with the fall trade."

CONCORD, N. H.—Mr. G. B. Landis, on behalf of the Concord Land & Water Power Company, says they consider the outlook for business this fall to be very good, so far as local conditions indicate. They have recently contracted for power and lights to be furnished to the Boston & Maine Railroad shops in this city, and expect the average load to be delivered to them will be approximately 200 kilowatts; this is by far the largest extension which they expect to make in the way of new business. They are changing their present system of open arc lighting to enclosed alternating, both for commercial and street purposes—using multiple lamps for commercial and series lamps for the streets. When this change is completed the company will operate everything by alternating current, power, arc lighting and incandescent lighting. It expects to install one new turbine at the water power station and to direct belt it to a 200-kw three-phase generator, which will be the only additional generator capacity to be installed at present.

LOWELL, MASS.—Mr. H. T. Edgar, vice-president and manager of the Lowell Electric Light Corporation, remarks in regard to plants in his care at the cities of Brockton and Lowell: "Regarding the Edison Electric Illuminating Company, of Brockton, would say that we are installing three horizontal tubular boilers of 150 horse-power each, installing a new system of steam piping, putting in a new pump and heater and installing a cross-compound engine of 350 horse-power direct connected to two General Electric 125-volt direct-current dynamos. At Lowell we have installed during the past year four new boilers of the horizontal tubular type of 150 horse-power each, and a new heater of 2000 horse-power, and expect to put in next month a 750-hp cross compound condensing engine made by the International Power Company, Providence, R. I., direct connected to a 500-volt 500-kw General Electric generator. There has been quite a demand in Brockton for enclosed arc lamps. In Lowell we have connected up within the last year about 350 alternating enclosed arc lamps, about 5000 incandescents and about 500-hp in motors. We expect in both cities to do quite a large business this fall."

GALVESTON, TEX.—Mr. John R. Cox, superintendent of the Brush Electric Light & Power Company, says: "We have just completed an entire change of our system as applied to the business district of this city, having eliminated all series arc generators and A. C. system, replacing same with 3-wire 220-volt service. The results are very flattering. Conditions peculiarly local have led us to certain changes not usually considered good practice. We are not installing arc lamps free of charge, but consider them as part of the consumer's equipment, regarding ourselves as an electricity supply station only, selling only by meter, discriminating as between light and power service, but otherwise without regard to the translating devices used by the consumer. Having a long summer, we have a large fan business, which has and will continue to grow very rapidly next year. This business was handled from 500-volt D. C. machines, now replaced by the 3-wire system. The latter system has encouraged the liberal use of the "buzz" or rotary fan not hitherto successfully operated here. The general outlook for current demand is very good for the coming season, which has been stimulated by the changes above referred to.

HOUSTON, TEX.—The General Electric Company, Schenectady, N. Y., has recently installed for the Citizens' Electric Light & Power Company, Blake Dupree, receiver, under the direction of W. H. Chapman, resident engineer, a new and modern electric light plant. The building is of brick and steel construction, fire-proof throughout, containing steam and electrical machinery of about 1000-hp. Contracts are already let, however, for 1000 additional hp. The alternating current-distributing system has been entirely remodelled, and in the business part of the city we have installed a four-wire, three-phase, secondary system, fed by banks of transformers, three to a bank. It is intended in the near future to extend the lines of the company throughout the residential parts of the city, and the managers confidently expect to work up a large business in residential lighting and fan service, which part of the business has heretofore been neglected. Mr. W. W. Reed, electrical engineer, says: "With our present capacity we are not in a position to take on a great deal of new business, but upon the installation of the additional 1000 hp we expect to increase our commercial business during the next year or so about 100 per cent."

MANCHESTER, N. H.—The Manchester Electric Company, which has just been formed, consolidates three other companies. Mr. J. Brodie Smith will have the general management. The two companies gathered in are the Union Electric, of Manchester, and the Merrimac Electric Light, Heat & Power Company, of Hooksett. The deal puts the electric light and power business of Manchester, Hooksett, Suncook and Goffstown all in the hands of the Manchester Electric Company, and gives it the control of two water power stations on the Merrimac River, two on the Squog River and a large station driven by steam power here in the city. The capital of the Union Company is $200,000, of the Merrimac Company $250,000, and of the Manchester Company, including the electric lighting company, the street railway and Garvin's Falls, $1,000,000. Thus the total is $1,450,000 The new combine can now serve out 17,400 horse-power of electricity in times of low water, and in fairly high water over 20,000 horse-power. This is divided as follows: At Garvin's Falls, 6000 horse-power developed from the water; at Hooksett, 4000 horse power from the water; at Kelley's Falls, 1000 horse-power from water; at Gregg's Falls, 2500 horse-power from water; on West Brook Street, 3000 horse-power from steam, and at Kelley's Falls, 900 horse-power from steam.

CINCINNATI, OHIO.—Mr. W. F. White, general manager of the Cincinnati Edison Electric Company, favors us with the following: "The prospects for large sales of electrical energy are very encouraging. The connected load of the Cincinnati Edison Electric Company has, during the first seven months of the present year, been increased by almost 50 per cent. There are no present indications of any discontinuance or lessening of this growth. Evidences of the growing popularity of electric light and electric power, and of the consequent increasing demand for electric service are at hand in every direction. This company is, therefore, largely adding to its capacity, both generating and distributing. Three thousand kilowatts additional generator capacity is being installed, and a 1000-kw storage battery is being erected. Fifty miles of underground feeders and mains are to be placed this year. Three-phase alternating work is also being undertaken, and an initial order for two 500-kw 4500-volt three-phase generators has been placed. The general outlook for the electric lighting and power industry appears most promising, not only in Cincinnati, but throughout the country. The demand for both lighting and power service is constantly growing, and therefore electric manufacturing and electric supply companies may confidently count on a continued season of prosperity."

BUFFALO, N. Y.—The Buffalo General Electric Company is making additions to its plant consisting of one 150-kw booster set, one 800-kw motor generator set on the three-wire system and one 400-kw motor generator set, 60 cycles. These extensions are made in anticipation of business for another year incident to the Pan-American Exposition besides the work which is under way in the city, contracts having been made with the Government to light the new post office and other buildings. There seems to be a tendency, General Manager C. R. Huntley says, to use, in business houses, more electric light, and a growing sentiment seems to exist favoring the abandonment of private plants for service from public mains. Buffalo, as you well know, is peculiar in its situation as regards the lighting of houses. Welsbach and natural gas is attractive because of its cheapness, gas being sold for 27½ cents per thousand. However, where people want good light, and are not looking for a light to serve the double purpose of a stove and illuminant, electricity is in favor. The tendency of the times seems to go towards reduction in price. The company has recently adopted a sliding scale of rates for all consumers, starting at 12 cents a kw-hour for one hour's burning of transformer capacity, and reduced so that at the end of six hours' burning on 26 to 30 days, according to the installation, it is 6 cents per kw-hour. The company has found that this plan meets with considerable favor on the part of consumers, as they realize that if they burn much light they will get it at a reduced price.

BELLEVILLE, ILL.—The following are the improvements made recently by the Belleville Gas Light & Electric Company in its electrical station during the past year and those contemplated for the future: One Wood No. 8 60-light 2000-cp arc dynamo and one Wood 75-kw 1100-volt single-phase A. C. dynamo of 16,000 alternations per minute have been replaced by a G. E. 120-kw belted single-phase 2080-volt A. C. dynamo of 7200 alternations per minute. A new switchboard is being made for this machine, and will include one generator and one feeder panel. The generator panel is to contain indicating ammeter, indicating wattmeter, ammeter for field circuit, voltmeter, main oil and field switches, transformer, fuse blocks, etc. The feeder panel is to contain an oil switch, electrostatic ground detector, ammeter, induction wattmeter, fuse blocks, lamp brackets, etc. Wirt lightning arresters are installed along the line, and 130 old transformers of 2230 lights capacity with 52-volt secondary voltage have been supplanted with 20 Type H G. E. transformers of 2530 lights (126,500 watts) capacity, with 104-208 secondary voltage. These transformers are now supplying current for 2100 16-cp incandescent lamps connected and 75 enclosed long-burning A. C. arc lamps, in addition to the incandescent lamps formerly fed by the old transformers. Mr. W. E. Steinwedell, superintendent, says: It is our intention, and the switchboard is designed, to extend for a 300-kw alternating-current dynamo, which will be direct-driven by a 22 x 36 heavy-duty Corliss engine of 450-hp at 120 r. p. m. This dynamo will carry the peak of the load, and run 150 A. C. series arc lamps for lighting the city.

STATEN ISLAND, N. Y.—The New York & Staten Island Electric Company, West New Brighton, S. I., is to make a large increase of plant. The following is a list of the material the company intends to install: There will be two 500-kw rotating armature, two-phase, 60-cycle, 2200-volt alternators direct connected to two vertical cross compound Allis engines. This equipment is to run in connection with two 20-inch central condensing systems furnished by H. R. Worthington & Sons. The dry vacuum pumps in connection with these condensers will be furnished by the same company. The centrifugal pumps for the circulation of water will probably be built by the Lawrence Machine Works, but will be furnished by H. R. Worthington. There will be two compound duplex outside packed boiler feed pumps. There are to be two tandem compound exciting units, built by the Ridgway Dynamo & Engine Company; engines direct connected to 110-volt Thompson-Ryan dynamo. There are also to be two Worthington 750-hp heaters and a battery of 2000-hp of boilers, type as yet undecided, with which will be a complete stoker equipment furnished by the Acme Stoker Company. The coal handling machinery will be furnished by Haskins & Coffin, and there is to be a 300-ft. stack built by the Alphonzo Custodos Chimney Con-

struction Company. There are to be two air compressors furnished by Laidlaw-Dunn-Gordon, and a new switchboard will be constructed by the General Incandescent Arc Light Company. It is to be 135 ft. in length and 109 ins. high. Mr. A. B. Proal, Jr., is chief engineer.

NEW BEDFORD, MASS.—President G. R. Stetson, of the New Bedford Gas & Edison Light Company, says: "This company has during the year laid the foundation for a change from the general overhead distribution to the underground system, having completed the installation of a line of conduits extending the entire length of the business portion of the city. We shall, during the fall, endeavor to complete the installation by the drawing in of the necessary cables. This will probably be the principal work of the company for the year. The growth in the electrical demand, while not as vigorous as in the larger communities, seems to be healthy, as the demand is steadily increasing. During the past year there has been a greal deal of activity in the legislative field, in the inquiry and general introduction of measures affecting the lighting interests. The decisions growing out of these measures are not entirely settled as yet throughout the state. Usually they are being worked out on a conservative basis, and, we believe, without any serious impairment of the vested interests. The principal part of this agitation, however, was more directly pointed to the gas than to the electric—although both interests were considered in the general work of the legislature. As far as I am able to judge from intercourse with managers of the electrical interests of the State they are all making an effort to give such service to the public as to obviate criticisms, and are looking for the best method to accomplish this purpose. They desire to avoid all criticisms that might be used against the service as rendered, and generally, while it is not best to prophesy without you know, I should judge that the electrical interests of the state were in a healthy and progressive condition, with a fair prospect for the future.

SALEM, MASS.—T. Fred Smith, general manager of the Salem Electric Lighting Company, writes us: "While our station, when it was built in 1889, was one of the most, if not the most, up-to-date station that had been built up to that time, we realize that many changes, some of which proved to be more desirable than others, have been brought out in the meantime. Such changes as we thought desirable and necessary have, from time to time, been adopted by ourselves, but no change has been made that probably affects the company as much as the change which we are about to make in the matter of replacing all of the street lamps, now used by the city, which are the Thomson-Houston 2000-cp open arc lights, with the series alternating 6 ampere, General Electric enclosed arc lamps. This change is being made as rapidly as possible, and by Oct. 1 we expect to have in operation 300 6-ampere enclosed arc lamps, and 200, or upwards, 30-cp series incandescent lamps on the same circuit. These will replace the present number of 190 arc lamps and 625 30-cp 3½-ampere series incandescent lamps. At this writing I am unable to state that any other changes at our station are to be made, other than the installing of the necessary apparatus to operate the lamps before mentioned. We shall, however, adopt from time to time such apparatus and make such changes as we find desirable, to continue the best possible service to the city, as well as to our commercial customers. As to the future outlook for the electric lighting of Salem, I see no reason why we should not continue to increase as much in the future as we have in the past. There are in this city, which is principally a residential city, already installed about 20,000 incandescents, more than 100 stationary motors, and upwards of 150 arc lamps by commercial customers."

COVINGTON, KY.—Mr. Chas. H. Shaw, of the firm of Stallo, Shaw & Shaw, lawyers, of Cincinnati, has been operating, as receiver, the Suburban Electric Company, of Covington, Ky. He writes us: "I cannot call myself a skilled electric light man, but from the experience had in running the Suburban Electric Company in Covington, Ky., which plant lights Bellevue, Newport, Dayton and Covington, Ky., I have come to the conclusion that the people prefer electric lighting for home use, if the service rendered is efficient and free from the annoyances occasioned by "grounds," etc. The demand for electric lighting at our office is greater than we can fill. This is occasioned, however, by the fact that the plant is being operated in bankruptcy for the purpose of winding the same up or selling it out as a running plant, and, of course, the bankrupt law is scarcely broad enough to permit or warrant a trustee in bankruptcy making the necessary improvements to enable the plant to carry the additional load offered. Any property administered in the courts, so to speak, is handicapped by the uncertainty attendant upon litigation and the action of creditors. Gasoline machines and appliances for private lighting have made but little inroad in this neighborhood, and have not appreciably affected the demand for electricity. The prices obtained in this neighborhood for street lighting are profitable, as we receive $90 per year per arc light, 2000 candle-power commercial. Since I took hold of the Suburban Electric Company's property I have been able to bring its earnings up to about $2,700 per month net, and this, too, without any appreciable increase in the running expenses and without making certain much-needed improvements and additions. The property is advertised to be sold on Sept. 25, and the purchaser will make a very profitable investment, in my judgment."

CLEVELAND, OHIO.—Mr. Samuel Scovil, vice-president and treasurer of the Cleveland Electric Illuminating Company, says: "We are making a further extension to our plant. In relation to the extensions which have been made to the Cleveland plant, it is interesting to note that when it was completed, in 1895, the alternating current belted generators were tucked away nicely in a small corner of the dynamo room, and they so remained without any change being made until 1898. Now, of the total generating capacity installed in the plant, all direct connected, 40 per cent of it is alternating current apparatus. This is the result of the improvement in the alternating current arc lamp, and in the development of the alternating current motor. The relatively high price demanded for the alternating current motor prevents, in many cases, the installation of these motors. If the manufacturing companies would make the price more nearly that of the direct current motors there would be a rapid development in the installation of alternating current motors, as for many classes of work they are preferable, requiring as they do little or no attention. The electric lighting business is not apt to be as good relatively this season as it was last. Last season the Central Station Company had the benefit of an increased use over the previous year of the lamps previously installed on its system; trade being good, the merchants used their installations very freely for advertising and other purposes. This year there will be no increase in revenue from this service, but rather a decrease; for, while it may be true theoretically that the time to advertise is when business drags, generally speaking the tendency then to cut expenses prevails with the average merchant. Any increase which the larger stations will secure this year will therefore be derived from new connections only."

HACKENSACK, N. J.—Mr. C. W. Thomas, treasurer of the Gas & Electric Company of Bergen County, says: "We have a very considerable amount of new work in course of construction in both our gas and electric departments and in both the plant and street construction. At the works, a new boiler room 60 x 75 is almost completed, and we expect to install in it within the next few weeks four 350-hp Sterling boilers, with a self-supporting steel stack 90 ins. by 150 ft. This building is planned to take another battery, the duplicate of the one just above described. When we installed our last 350-kw direct connected unit last year, we put up a building large enough to take a still larger unit, and we have made the contracts, and expect to install, some time during the winter, a direct connected unit consisting of an 825-kw Stanley two-phase generator identical in style to those we now have, and a 1325-hp (at one-quarter cut-off) upright cross compound McIntosh & Seymour engine, together with complete condensers, heaters, etc. We have had, the entire season, a large construction gang continuously at work erecting new pole lines in various directions, and have already constructed a good many miles and covered a great deal of new territory, and they have ample work planned out to keep them busy for some time to come. On the gas side, the growth at least equals the electric department. As regards the general situation, I can only speak for our own field, as we have all been too busy to watch outside events very closely. With us the demand for extension in every line has been very heavy, and gives every promise of increasing. Our business for the summer shows great gains over our heaviest load for last winter, and thus far for some time past there has been a steady and healthy increase from month to month, regardless of the season. We are quite sure that our plant cannot be excelled for its size; all its appointments are modern and up to date."

ST. PAUL, MINN.—The St. Croix Power Company is developing a water power at Apple River Falls, Wis., a distance of about 28 miles from St. Paul, to be in operation on or about Sept. 15 next. The power developed at that point will be utilized by the St. Paul Gas Light Company and the local Edison Electric Light & Power Company. The current will be transmitted to St. Paul three-phase at a pressure of 25,000 volts on an overhead line to within three miles of the sub-station, at which point the 25,000 volts will be continued underground into the sub-station. From the sub-station the current will be distributed on to the Edison system through six 250-kw, 600 r. p. m., 60-cycle, six-wire rotary converters, General Electric make. Alternating current will be transformed from 25,000 volts three-phase to 2200 volts two-phase. At the power station at Apple River Falls there are installed four pairs of Victor turbines made by the Stilwell-Bierce & Smith-Vaile Company, each pair capable of developing 1375 horse-power under 80-ft. head at 300 r. p. m.; also two exciter wheels. The electrical equipment of the generating station consists of four 750-kw, 300 r. p. m., 800 volts, three-phase, direct connected, General Electric Company's make, with step-up transformers to 25,000 volts. The feeder pipe from the flume to the power house is made of steel, 12 ft. in diameter, with an 84-ft. head. The flume from the dam to the feeder pipe is about 1500 ft. long. The dam is 40 ft. high above the bed of the river, and is built into solid rock. The dam is built of rubble masonry with concrete facings. The transmission line consists of six No. 2 B. & S. gauge medium drawn copper wires. The cables connecting the transmission line to the sub-station are two, three wires each. One cable is paper, made by the National Conduit & Cable Company, New York, and the other is rubber, and is made by the Safety Insulated Wire & Cable Company, New York. The switchboard for the sub-station in St. Paul, which includes all high-tension switching devices, is made by the General Incandescent Arc Light Company, of New York. Mr. H. J. Gille is the superintendent of the electrical department of the St. Paul Gas Light Company.

Tesla Rotating Magnetic Field Patents Sustained.

At Hartford, Conn., on Wednesday, Aug. 29, Judge Townsend, in United States Circuit Court, sustained three Tesla patents as broadly covering the rotating magnetic field principle of transmission and motive power. The patents considered are Nos. 381,968, 382,279 and 382,280, of May 1, 1888. The case was that of the Westinghouse Electric & Manufacturing Company against the New England Granite Company, which has been using Cushman phase motors supplied with current from a General Electric three-phase generator. The case was fully reviewed in ELECTRICAL WORLD AND ENGINEER Nov. 18, 1899. The full text of the decision is not available as we go to press, but Judge Townsend characterizes the invention as follows: "Tesla's invention, considered in its essence, was the production of a continuously rotating or whirling field of magnetic forces for power purposes by generating two or more displaced or differing phases of the alternating current, transmitting such phases with their independence preserved, to the motor, and utilizing the displaced phases as such in the motor."

In the course of his decision, Judge Townsend says: "A careful study of the evidence shows that Tesla has made a brilliant discovery. It remained to the genius of Tesla to capture the unruly, unrestrained and hitherto opposing elements in the field of nature and art and to harness them to draw the machines of man. It was he who first showed how to transform the toy of Arago into an engine of power; the laboratory experiment of Bailey into a practically successful motor; the indicator into a driver. He first conceived the idea that the very impediments of reversal in direction, the contradictions of alternatives might be transformed into power, producing rotations, a whirling field of force. What others looked upon as only invincible barriers, impassable currents and contradictory forces, he seized, and by harmonizing their directions, utilized in practical motors in distant cities the power of Niagara. A decree may be entered for an injunction and an accounting as to all the claims in suit."